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CANADIAN MACHINERY AND MANUFACTURING NEWS

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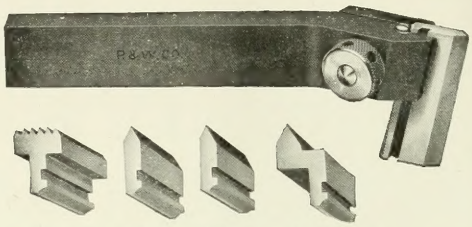
SMALL TOOLS

P. & W. Threading Tools



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A few of its advantages:

Threads can be cut very close to a shoulder.

Tools are sharpened by simply grinding of top of cutter.

Combines economy with all features essential in a threading and forming tool.

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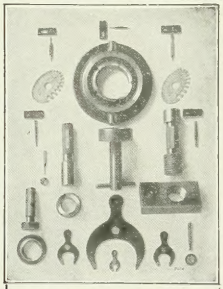

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The Publisher's Page

TORONTO September 13, 1917

What of the Future?

Probably at no time in our past history as a nation has there been so clear cut a mile post on the road of events as the situation that now presents itself to Canadian manufacturers.

That first period of a hasty grabbing of any business offering has passed. Things are again on a settled basis—one that will, with changes corresponding to the developing situation, rule for many years to come.

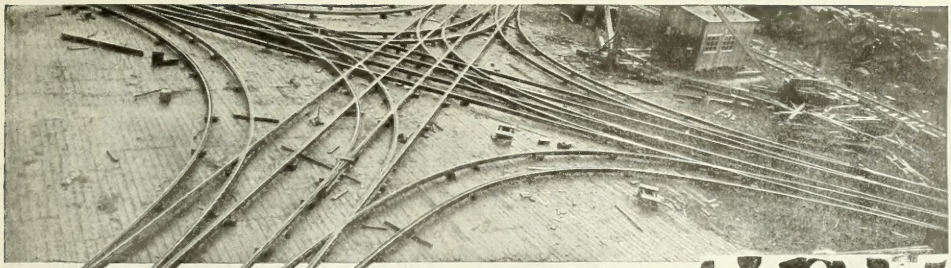
The plans laid now will bind the manufacturer for an indefinite period. It behooves him to select wisely and well—whether he sticks to his old lines or embarks on new ones. The main essential is the choosing of a line that not only includes a present demand, but that promises one for the future.

The selection and manufacturing of a line, as every wide-awake manufacturer knows, is not the greatest problem confronting him. That is the distribution, the marketing, the selling of his finished product, and is a point which must have serious consideration. To that end it is to be hoped that all manufacturers develop their sales end on the broad lines advocated by the head of the great Selfridge Stores in London. In an interview in last week's issue of the *Saturday Evening Post*, referring to American manufacturers and which is equally applicable to Canadians, he says: "Merchants must be prepared to advertise extensively."

The history of the war has proven to the hilt all the more reasonable claims ever made for advertising by its friends. Every government has used it successfully to recruit soldiers, finance loans, encourage thrift and to gain other vital ends.

May we hope that this great lesson of the war will not be lost on us in planning our newer future.

If any advertisement interests you, tear it out now and place with letters to be answered.



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Canadian Steel Foundries, LIMITED
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We guarantee shipment within 24 hours of receipt of order

"Extra" "Special" "High Speed" **Tool Steels**

SISCO

Made in Sweden from selected Dannemora Ore

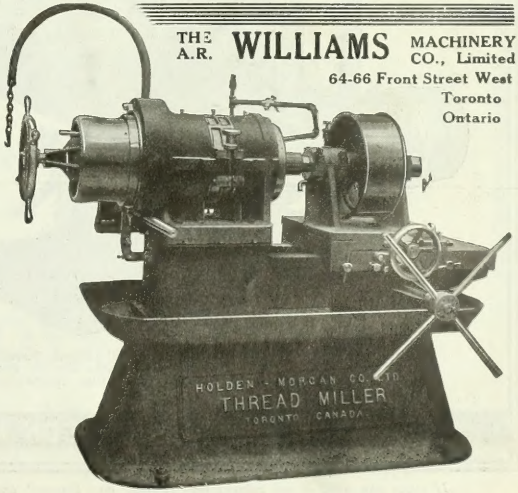
We also carry in stock Solid and Hollow Drill Steel, Die Blocks, "SISCO" Welding Wire, Drill Rod and Swedish Iron.

Swedish Steel & Importing Co., Ltd.
MONTREAL, QUE.

The Life of a Thread Miller

Depends not upon the amount of work it does, but the ease and thoroughness with which the work is done. These Thread Millers are noted for these qualities. Its quality of work is unrivalled. Our Service Department will give you all the particulars. *Write us!*

THE A.R. **WILLIAMS** MACHINERY CO., Limited
64-66 Front Street West
Toronto
Ontario



If any advertisement interests you, tear it out now and place with letters to be answered.

If any advertisement interests you, tear it out now and place with letters to be answered.

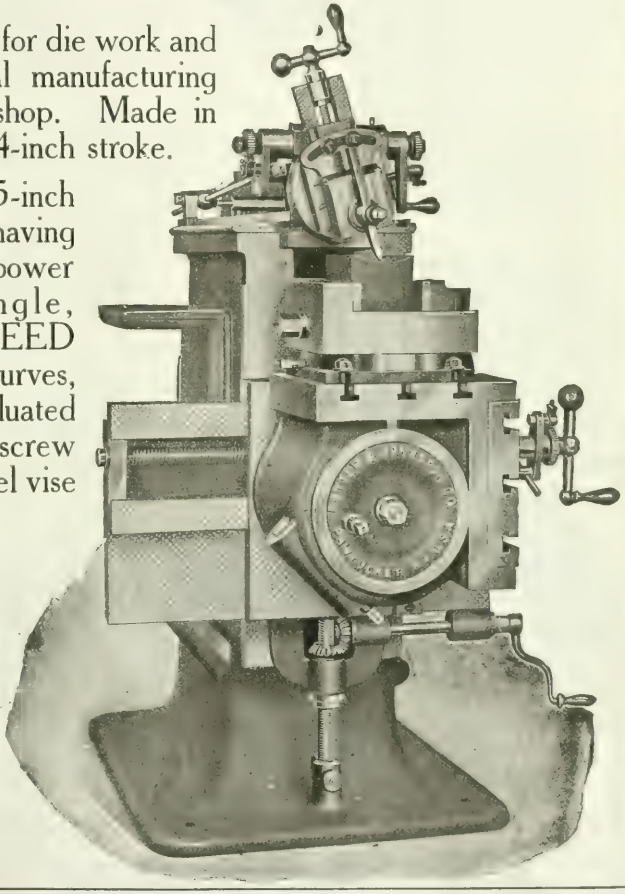
Potter & Johnston 15-inch Universal Shaping Machine

15-inch Stroke — 24-inch Stroke

The standard of efficiency for die work and tool room service, general manufacturing purposes and the repair shop. Made in two sizes—15-inch and 24-inch stroke.

Illustration shows the 15-inch model with swivel table having auxiliary tilting side, power down feed on any angle, POWER ROTARY FEED for planing internal curves, automatic feed stop, graduated collars on tool head feed screw and table feed screw, swivel vise with graduated base.

The simplicity of design, convenience of operation, extreme care exercised in their manufacture, and the many universal features of this machine, combine to make it the most efficient and reliable tool of its type.



WRITE FOR PRICES AND DELIVERIES

Canadian Offices **Potter & Johnston Machine Co.,** Pawtucket, R.I.

ROELOFSON MACHINE & TOOL CO., LTD.

Head Office: 1501 Royal Bank Building, TORONTO, CANADA

Works and Warehouse: GALT, ONT., CANADA

If any advertisement interests you, tear it out now and place with letters to be answered.

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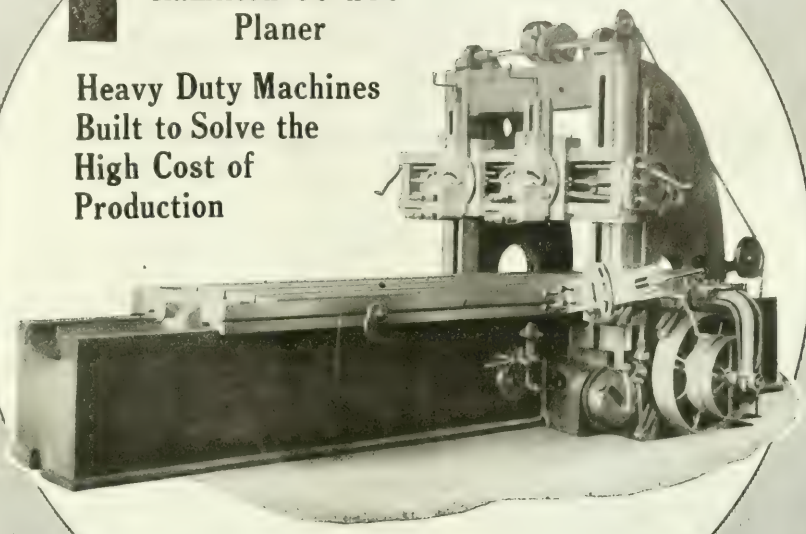
HAMILTON

PLANERS

Hamilton 36" x 36" Planer

Heavy Duty Machines Built to Solve the High Cost of Production



WEIGHT, RIGIDITY, DIMENSIONS and POWER—these are the combination of assets that give exceptional productive ability to "HAMILTON" PLANERS.

The installation of the "HAMILTON" strikes a crushing blow at the High Cost of Production. They do big work fast and accurately. Sizes from 24" x 24" to 54" x 54".

Our bulletin will tell you all about this planer. Give us your address.

The Hamilton Machine Tool Company, Hamilton, Ohio

H. W. PETRIE, LIMITED, TORONTO, Sole Agents for Ontario.

If any advertisement interests you, tear it out now and place with letters to be answered.

If any advertisement interests you, tear it out now and place with letters to be answered.

FLINT SHOT ENLISTS!

AS A HELPER IN SHELL-MAKING

"SOMEWHERE IN MICHIGAN" The Flint Shot Man visited a plant that has recently completed a big order of 6-inch shells for one of the Allies.

At a certain point in the early part of of the operation the shell is a cylinder closed at one end.

To give this cylinder the proper conical taper, the open end is heated in an oil furnace, and the end is compressed in a hydraulic press, a mandrel keeping the top open.

The oil flame leaves an incrustation of scale on the inside of the shell. This scale must be removed—absolutely.

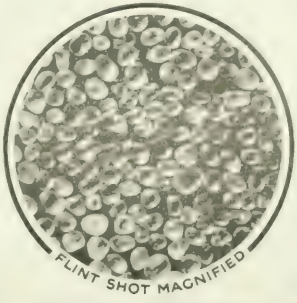
Flint Shot did it. We are not permitted to publish details, but it is violating no confidence to say that the shell is inverted and revolved, while the nozzle of the Mott machine discharges its fusilade of Flint Shot at a glancing angle inside the shell, each nodule of flint, taking several "bites" before its power is spent and it sifts out through the inverted opening.

A blast of clean air is then used to remove adhering dust.

The general superintendent said that lake or ocean sand was found to be too soft for this work and that steel grits were too violent in their action—Flint Shot occupying the happy medium between the two.

Flint Shot, therefore, hereby enlists as a private in Liberty's industrial army, ready for duty in shell work or any other kind of metal cleaning.

If you have a shell contract or expect to get one, better look into this. Send for further particulars.



UNITED STATES SILICA CO.

SOLE PRODUCERS OF FLINT SHOT

430 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

Saving Money Studying Materials and Watching Scrap Heap

By Wilfrid G. Astle

The flow of raw materials into any factory, public service plant, railway system, or, in fact, any kind of a business, is bound to be continuous and will go on as long as the business runs at all. When these materials begin to flow out, as finished products or service, there may be a notable shrinkage, a large proportion of which can be traced to lack of efficiency in studying materials combined with neglect of scrap heap and general lack of interest.

BUSINESS has now entered upon a new era of economy, and every item is being subjected to a thorough examination by the modern business manager for the purpose of detecting and abolishing any waste. The four big groups under which this problem is being studied are Burden, Materials, Labor and Management. The greatest possibilities for saving are found in the item of materials, because out of the twenty billion dollars' worth of goods manufactured yearly, more than twelve billion dollars of this is cost of materials—the raw stuff out of which product is made, with tools to make it. That is three times the cost of labor and supervision.

After the efficiency man has come another specialist, who is known as the economy man, whose duties are to browse around the plant to see what is being used; how it is being handled; what is spoiled, thrown away through ignorance, carelessness and use of wrong materials. His supervision begins with the raw materials coming into the plant, with authority to change these if he can effect sane economies by substitution and improvement. His supervision then extends through the works, with its countless opportunities for leaks and extravagance, out to the scrap heap, where he often finds suggestions that, in turn, help him to develop better standards in the purchase of more material.

Street Railway Methods

One of the largest street railway systems in Canada has a system of concentrating at their main shops all responsibility for life of material. The car maintenance department is held responsible for all supplies from the time that they leave the storekeeper on requisition indorsed by the master mechanic, until he returns them back to the storekeeper as scrap. The question as to what is scrap is not left to the foremen for determination, but to two specialists. These men divide all return material into three heaps, the first is called "good for repair," the second "doubtful," and the third "rejected." The master mechanic has the last word as to what doubtful pieces shall be repaired. The scrap is carefully weighed and turned over for formal receipt by the storekeeper. Allowance is then made to each carhouse under the proper account number, and finally the auditing department assigns the credits on a money basis. The manifest which accompanies the material returned by any of the carhouses is regarded as an order for substitute material. The sub-stores at the carhouses can order as new only such material which is not subject to repair, but even these orders must be approved by the master mechanic before going to the storekeeper. No carhouse receives substitute parts unless it returns an equivalent number of old parts. The necessary adjustments for lost material are made monthly.

This system has been in use for some time and has proved very successful, especially in avoiding the unnecessary scrapping which arises when carhouse men are too eager to get rid of material which, while old, is still capable of repair and perfectly safe for re-use.

Economy of materials in designing and buying is very largely a technical matter, and there is plenty of room for technical improvements in methods when materials pass out of the storeroom into the works. More often, however, the problem is a human one; and the economy man cannot go very far until he has enlisted the co-operation of all the employees by pointing out to them waste, has developed better methods, has made clear the reasons for carefulness with materials, and has roused an economical spirit in the whole organization.

Electrical Concern's Operations

In handling its scrap, a large electrical company in New York holds the supply department responsible, as they are more familiar with the materials and the best methods of handling and disposing of them. The scrap material when received by the stores department follows the same routine as new material; that is, the weights are taken gross, by the receiving clerk, after which it is delivered to the yard foreman, who is in charge of the scrap shed. It is then separated and the weight of each class of bare metal, brass, copper, lead, etc., is taken separately before it is put into its respective bin. A credit slip itemizing the material is then issued to the job, and sent to the clerk in charge of the scrap ledger, who prices it at the value of the last scrap sale, posts the items in the scrap ledger, and forwards the original copy to the credit slip to the accounting department, where it eventually becomes part of the job order system.

Leaded and braided cables and underground tubes are put into ovens and redeemed as pig lead and bare copper. The loss resulting from this process is deducted from the gross figures, the net amount only being credited to the job. The iron piping from the underground tubes is redeemed where possible and returned to stock for further use. Short or crooked lengths are scrapped. A reduction oven is used in withdrawing the copper from these underground tubes. The oven is fitted with bars at intervals, each bar being higher than the preceding one, so that when the tubes are inserted, the rear end is about three feet higher than the end at the oven door. A fire is built under the tubes from the side of the oven and this becomes sufficiently hot to melt the compound, which flows from the tubes by gravity and feeds the flames. After the compound has run out, the copper is easily withdrawn as clean copper, and the tubes are either repainted or sold for scrap, depending upon their condition. The copper withdrawn from the tubes is cut up into small pieces and put into hogsheads and shipped monthly.

Another style of oven as used by this company is for burning the compound out of old junction coupling and elbow boxes. The compound is melted and burned out, and the iron is for the most part repainted and used over again. Such material as cannot be thus treated, is sold for scrap. Into still another oven all the short pieces of braided and leaded cables returned from jobs, and the insulated wire of all kinds are thrown. The bed of this oven is of concrete and is sloped toward the rear right-hand corner, so that the molten lead will run by gravity into a pot outside the oven. Here the dirt is skimmed off and the lead is taken up in ladles and cast into pigs, in which condition it is sold. The insulation having been entirely burned and the lead having run off, clean copper remains, and this is removed and packed into hogsheads for shipment as stated above.

Economy Every Employees' Concern

The cost of raw material has been steadily rising, wages have been increased, and prices have not been able, in a great many lines, to keep pace with this increased cost. Profits have shrunk everywhere, and to-day the business man must run his business on a much smaller margin than was common five or ten years ago. As practically everybody connected with the business organization is doing something with materials, the tracking down of waste and leakage is one of the big problems of modern management.

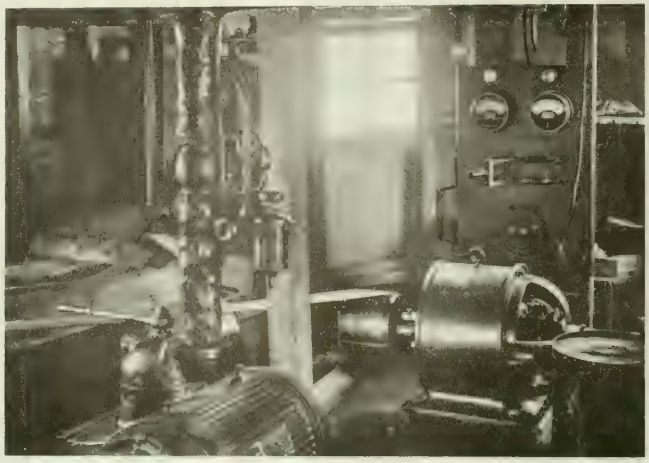
A large railway system, which used to collect its scrap material and junk at a central point and sell it to the junk dealers when it had accumulated, now has a large shop fitted up with machinery for working over each class of material and testing its output. New tires are put on car wheels formerly sold for a cent a pound, and they give years of additional service. Old rails are re-rolled and redrilled and sold to smaller roads. Old springs are retempered and the babbitt metal is melted out of old journals. A magnetic separator winnows iron and steel from brass in mixed scrap, nuts and bolts are rethreaded; thrack spikes

are cleaned of rust and resharpened; tie plates, car wheels and car couplers are reclaimed. A vast assortment of crippled tools are made serviceable and sent back, such as shovels, tamping picks, track drills and jacks.

Then again, another firm of machinery manufacturers which uses large amounts of cotton waste in its factory, has been accustomed to throwing it in a corner when it became well soaked with oil. Each day it was gathered and burned up in the furnaces, as is quite customary the world over. But one day a man came to the manager and asked permission to periodically gather up the oil-soaked waste and replace it with clean material. The manager told him to go ahead provided money could be saved on the purchase of new waste; then he asked how much the service would cost per pound waste. He was surprised when the man replied that the new waste would not cost him a cent—that the oil-soaked waste would be gathered up and replaced with the same amount of new waste without charge. On investigation, it was found that this man had a little plant on the outskirts of the city where he gathered oil-soaked waste from nearly all industries in that entire section of the city. There he put the oil-soaked waste through a pressing and washing process by which it was cleaned so well that it looked like new. When the oil he pressed out was cleansed and filtered, he got three or four different grades, which he sold for approximately five times his cost of producing it. Many industries clean their own waste and make a good profit over the cost of cleaning it for re-use. The oil, which is easily drained off the top of the wash, is readily marketable at a price that much more than pays for the process.

The bonus idea has been applied to the saving of material as well as the saving of time, and employees share in economies; but, even without bonuses, there is little difficulty in showing men how economies benefit them by making it easier for their employers to meet competition, extending the business, and providing steadier work and higher wages.

The careful scrutiny of the scrap heap will bring about better standards in the purchase of new materials, because defects in the design and workmanship will be discovered, and then again, instances have been known where manufacturers have replaced articles when the defects have been called to their attention. Under the old scheme of selling scrap there would have been no claim for replacement.



INTERIOR OF TUG "ALBERT" SHOWING ELECTRIC GENERATING PLANT FOR SUPPLYING CURRENT FOR WELDING.

MARINE REPAIR TUG WITH WELDING EQUIPMENT

THE characteristic activities that have marked the recent developments in the marine and shipbuilding industry have also necessitated the utilization of every available resource to meet the increasing requirements for additional lake and ocean tonnage. Every conceivable method that would assist in this essential need, has been adopted and pressed into service, to the extent that remarkable results have already been achieved, with still greater ones to follow. A very important factor in maintaining maximum facilities for water transportation is the rapidity with which repairs or alterations can be accomplished upon vessels in transit or in harbor, or such other marine work that requires immediate attention.

The art or science of welding, particularly by the electrical and oxy-acetylene processes, has rapidly advanced to a leading position in engineering practice, both for repairs and general construction work, the marine field being not the least of its many activities. The illustration herewith show the tug Albert, now in the service of the St. Lawrence Welding Co., of Montreal, which has been in operation for several years on the Great Lakes and the River St. Lawrence from Quebec to Fort William. The boat is equipped with a 60 h.p. Fitzgibbon boiler and is operated by a 10 x 10 inch single cylinder high pressure marine engine, providing a maximum running speed of 12 miles an hour. To meet the requirements of general welding practice, the boat has been fully equipped for welding operations, by either the electric or oxy-acetylene process. The installation for the former consists of a 35 horse-power Robb Armstrong horizontal high speed engine, belted to a British Westinghouse 300 ampere generator, complete with switchboard and resistance. For electric welding, 700 feet of insulated cable is carried in reinforced rubber hose, thus providing facilities for effective operation at a considerable distance from the tug.

For the operation of pneumatic tools, compressed air is supplied by a 12x11x12 inch Westinghouse locomotive type air pump, which with receiver, has ample capacity for the operation of three sets of tools. In addition to the working equipment, the vessel is provided with a duplex fire pump and efficient life saving apparatus.

During winter this company operates portable Electric and Oxvacetylene welding apparatus, principally on marine boilers of the several lake vessels that are tied up, and also executes a large amount of digester repair work in connection with pulp and paper industries.

TUG "ALBERT" EQUIPPED WITH ELECTRIC WELDING OXY-ACETYLENE AND PNEUMATIC TOOL PLANTS FOR SHIP REPAIR WORK AFLOAT.

PAPER IS MADE OF RICE STRAW

THE first unit of a factory to make news print paper from rice straw and from bagasse—the waste of sugar mills—has been installed and is in successful operation at New Iberia, La. To all appearances, and according to statements mde by the management of the mill, the paper produced from these two products, hitherto regarded practically as waste, is as good as that made from wood pulp in northern paper mills.

The corporation that is making the paper first purchased an old shingle mill and 18 acres of land extending from the Bayou Teche, across the heart of New Iberia, to the Southern Pacific Railroad. This gives excellent manufacturing and distributing conditions, for power boats and barges bring the rice straw and the bagasse from fields within a radius of 200 miles along the Bayou Teche and tributary streams, while the finished product of paper goes out at the other side of the plant directly to the cars of the Southern Pacific for distribution to northern and eastern markets.

A wharf, spur tracks, "digesting building" and warehouses have been built, and the first ton of paper has been made. The Bayou Teche is the central waterway of the picturesque Louisiana section immortalized by Longfellow, and known even to its own inhabitants as "Evangeline's Land." It comprises the largest rice belt in the world, and produces hundreds of thousands of tons of sugar as well. From the immediate neighborhood of New Iberia the output of rice straw is 20,000 tons yearly, while beyond Iberia Parish, but tributary to it by navigable waterways, lie the rice-growing parishes of Vermillion, Lafayette, Acadia, Allen, Beauregard, Jefferson Davis and Calcasieu, which produce hundreds of thousands of tons of rice straw annually, all of it being wasted.

MALLEABLE CAST-IRON

WITH the object of bringing before the attention of local manufacturers modern practice and investigation bearing upon malleable cast-iron in order, if possible, to obtain increased production, and at the same time to utilize some materials which have not yet been adopted in this country, Professor T. Turner of the University of Birmingham, has recently delivered lectures on the subject, under the auspices of the Ministry of Munitions.

In the course of these, he explained the practice of melting followed in the United States, where, he said, crucibles are seldom used, and cupolas are regarded as obsolete. Air furnaces, or open hearth gas furnaces, up to 25 ton capacity, are employed, with large annealing furnaces, charged through the roof, which is arranged so as to be removed in sections. The great difference in composition of the iron used relates to the sulphur which for the "black heart" process must be low, and usually does not exceed 0.08 per cent., while in the European process three times this quantity can be present without injury.

In each case it is now generally recognized that phosphorus up to 0.25 per cent. may be permitted, and even more is present in many good castings. The combination of mechanical tests with chemical and microscopical examination has led to a great imporvement in the trustworthiness of the material from good makers. A standard wedge test was formerly regarded as satisfactory if the stample stood seven blows with a hammer, but there is now no difficulty in guaranteeing 35 blows, and over 100 have been recorded.

TRANSPLANTING INDUSTRIES

A RECENT number of *The Iron Age* has a remarkable story which shows what business enterprise can do under the stimulus of war necessities. Nothing less than a world war, probably, would have made it profitable to pack up an entire blast furnace plant and all its machinery, and ship it bodily as far as India. This is precisely what is being done with the Battle furnace plant at Battelle, Alabama. The furnace, 85 feet high, with hoist, power plant, stoves, boiler plant, etc., is being dismantled, and in 60 days from the time the work was started will be on the seas, bound for Tata, India, where it will be erected again and set to work. If one could endow a blast furnace with a personality, as Kipling has endowed locomotives, this one may well be imagined to be somewhat amazed at its own adventures.

B.C. COPPER OUTPUT INCREASE

THE amount of copper produced by smelting in the Province of British Columbia in 1916 was 65,379,364 pounds fine copper, valued at the average New York market price for copper at $17,784,494. These figures represent the amount of copper actually recovered, as nearly as it is possible to ascertain; the amount of copper really in the ore mined would be approximately twenty-five per cent. greater. This is the largest copper output in the history of the Province.

As compared with the year 1915, these figures show an increased production in amount of 8,460,959 pounds, or about 14.80 per cent., and in value the increase is $7,948,994, or 55.3 per cent.

The amount of copper produced during the year 1916 is the largest in the history of copper mining in the Province, the highest previous production, made in 1912, was 51,456,537 pounds, valued at $8,408,513.

The apparently abnormal increase in the value of the production this year is partly due to the high average market value of the metal for the past year, due to the phenomenal demand for munitions of war.

Owing to this heavy demand for war purposes, principally for brass to be used in shells, the market price of copper increased steadily during the year. The year opened with copper at about 22.5 cents a pound in the New York market, and at the end of December it was 29 cents; the average price for the year was 27.202 cents, as compared with an average price of 17.275 cents in 1915. This higher market value of the metal assisted materially in raising the value of the copper produced, thereby greatly stimulating production.

The large increase in quantity of copper produced this year is due to a greatly increased production from the coast district of some 7,000,000 pounds, largely from the Britannia mine, while the Granby Company's Hidden Creek mine, at Anyox, on Observatory Inlet, increased its production by about 2,000,000 pounds, says the B. C. Financial Times. The output from the Rocher Deboule mine, in the Omineca Division, was rather less than last year. The Trail Creek Mining Division and the Boundary District made very nearly the same production as last year; the output from Kamloops was greater, chiefly due to increased production from the Iron Mask.

ALLIES' WAR PURCHASES AND AMOUNT OF LOANS

A DESPATCH from Washington, D.C., states that all of the first Liberty loan of two billion dollars has been loaned to the Allies. This makes an expenditure of this amount within the past four months on account of England, France, Italy, Russia, Belgium and Serbia in the American markets for munitions and other supplies needed on account of the war.

Congress has authorized the issue of but one billion more bonds with which to make credit loans to the Allies, and judging from the rapidity with which the first loan was spent, this will be but enough to last during the next two months.

The total expenditures by the Allies in the American markets for supplies are at the rate of three billion dollars a half year or probably more. It is estimated that probably four billions more will be spent by the Allies within the succeeding six months, making a total of such expenditures of seven billion dollars for the current fiscal year.

These expenditures are entirely separate from those which are made by the United States for war purposes. As a practical financial proposition these credit loans should be calculated as part of the war obligations of the Allies inasmuch as these Governments are liable for the interest and principal. The United States as a matter of fact merely lends her credit to raise the money for these Governments.

THE amount of carbon dioxide produced by the complete combustion of mixtures of gasoline vapor and air reaches a maximum of 2.5 per cent. of gasoline vapor, according to an investigation made by the Bureau of Mines, which showed that the range of complete combustion was limited to mixtures containing only between 1.5 and 2.5 per cent. Carbon monoxide begins to form above 2.5 per cent., and at 4.1 per cent. of gasoline vapor there is produced 14.0 per cent. of this gas.

NOTES ON SHELL INSPECTION

By Chief Examiner

SHELL making from a manufacturers' point of view, and shell-making from an inspector's—a government inspector's point of view, are often very different. The manufacturer, in the general run of things, has one end in sight, i.e. that of dollars and cents. There are, of course, a number who desire to make, if not the best article, certainly a good one, but others again, unfortunately, never forget the "profit" side of the question. These manufacturers necessarily influence their employees, and by means of piecework bonuses, and various methods of speeding up the operations, endeavor to hasten production at the expense of quality.

The government inspector on the job sometimes finds himself forced into arguments, which, if he is wise, he will side track. A good inspector must be a man with a large amount of common sense and diplomacy. The foreman in the shop sometimes finds himself facing problems in the manufacture of the shell, and if he is unscrupulous and cannot immediately see a way out of his diffculty, falls back upon the questionable practices, hoping that the inspector or his assistants may either not notice them, or, if the relationship between the inspection room and the firm is good—may overlook them. Again, questionable practices are sometimes resorted to, to save a little trouble or a little expense in an operation.

Instructions Numerous

The numerous circulars of instruction supplied to the chief examiner by his superiors, makes it necessary that he should possess a good memory, coupled with firmness in enforcing the execution of them, without antagonizing the firm, the foremen or the operators. Suppose, for instance, that owing to some carelessness on the shop inspection bench, a larger number of shells have to be sent out from the government room for "rectification," than is usual. This means that the government men have double work, that production is interfered with, and arguments arise which are sure to cause annoyance to both parties. What, then, is the best way to deal with this question, at the particular plant where it takes place? If the chief examiner holds strictly to the specifications of contract, he is at liberty to suspend inspection if there are over 5% of the shells in one series, not made according to blueprint,—in other words—"rectifications." To hold strictly to this, would, however, be as bad as holding a match to a can of gasoline, and would cause immediate unpleasantness. On the other hand, rectifications must be brought down to the minimum. A method which the writer has found very satisfactory, and which is fair, and just, is to warn the firm on the first occasion, threaten them with the consequences, on the second, and on the third occasion, act, and send out the whole series for shop reinspection, and once the action has been taken, hold firm and yield nothing—not even if a report from the firm to head office ensues. This should only be done, however, if say 20 or 25 per cent. excess rectifications are submitted. This method is almost a sure cure, and the chief examiner is able to say that he has treated the firm fairly by giving them three chances.

Production No Concern

A chief examiner must always bear in mind that production is no concern of his, if it interferes with quality, but he must never overlook the fact that the shells are needed at the front, and while strictly adhering to his instructions, he must not be fussy in his judgment, and must be broad-minded and ever ready to give allowance within his limits if he sees that the firm and the operators are trying to please him, but "are up against it." If, however, he finds that things—minor or important—are being put over him, he must take a firm stand, and never waver, no matter how unpleasant the consequences may be for him. He must, however, only go to the length he is permitted by his instructions—these may be, and sometimes are, of great latitude, and an inefficient examiner often has it in his power to cause an immense amount of unnecessary expense to the firm, therefore he must on no account be vindictive nor allow any personalities to enter into his actions. He is wise, therefore, if he is in the slightest doubt, to refer the matter to the head office, where it will be dealt with by those who are better qualified to judge.

It is very important that the chief examiner should thoroughly understand every operation which the shell he is working on goes through. This is, of course, much easier for him at the present day, owing to the instruction classes which every examiner—chief or assistant— must attend, and at which he must qualify before he is allowed to use a work-stamp. This work stamp is his signature and must be used by him only, and not lent to other examiners to use.

In the earlier days, when shell making was in its infancy, in this country, the chief examiner's position was quite different. There was not the work nor were there the responsibilities attached quite as much as there are now, when so many new methods, new instructions, new "marks" of shell, etc., have come into force. He is, however, just as responsible as he ever was for the quality of each individual shell that leaves the factory, but with the difference that his assistants are more qualified men than in the earlier days, when every new man was a "greenhorn."

The writer well remembers his first chief's job and the bunch of trouble he landed amongst. He made many mistakes which he did not recognize as such, and, in course of time, and after an immense amount of worry, he learned lessons which he will never forget. But he was always strengthened by the knowledge that in all he did, he was guided, first, by his instructions, and secondly, by his conscience, and he always tried to be just in his decisions.

Although there are very few cases of inducements being offered, and still fewer cases of them being accepted, still there are instances where this has been discovered and all I can say, is, that the chief examiner or assistnat, who would stoop to receive any favor, however small, to enable any firm or man to get away with bad work—I say such man is far worse than the poor soldier who, tired and weary, falls asleep at his post, and should be shot with far less compunction.

What He Must Know

He must never forget that he is at the particular plant to see that each, and every shell is correctly and perfectly made in every detail, and that the man whose duty to fire that shell has to rely absolutely and blindly on him.

He should know the composition of it, although steel examination only slightly enters into his province. He must watch any operation where the shell has to be heated—such as the nosing press—or hammer, and if the heat is allowed to travel too far down the shell, he must hold it in the inspection room until a tensile test has been taken from a batch of similar defectives The chief examiner must know sufficient of the entire manufacture so that if any foreman puts up an argument or excuse, he will be able to judge at once, if such has any real foundation, or is merely dust thrown in his eyes.

Ideal Conditions

To look at the other side of the question—when a chief examiner is at a plant where everybody is working harmoniously, then it is a real pleasure to be there. The trust that can be placed in the operators and foremen is bound to keep up good feeling all round. I do not say, however, that vigilance must be relaxed, because there is always a black sheep in every fold, and in nine cases out of ten, if the examiner gives an inch, a foot will be taken, and if there were any laxity in the inspection room, the foot would very soon develop into five yards, therefore, following the rule of three, as the system in the inspection room is to the work, so will the effect be felt in the shop.

A rigid inspection, coupled with broad-mindedness, firmness, civility and a little obligingness will naturally and automatically work towards the best of quality and the largest amount of production, always provided that the firm and its employees try to please the inspection department and do not attempt to kick over the traces, or break the harness which it is absolutely necessary to put on them.

EXPORTS PROHIBITED

A cable was received recently by H. M. Trade Commissioner in Canada from the Board of Trade, London, stating that the exportation of the following articles from the United Kingdom had been prohibited from August 14:— Lasts, shoemakers' machines and tools, various; malleable iron castings, ethylic alcohol, zinc oxide, and sulphide, metal cylinders, shark oil, rapeseed oil, vegetable seeds, tanning extracts.

Some Present Day Problems in Railway Maintenance Work*

By F. B. Tapley **

Railway maintenance as carried out by the department organized for the purpose is a constant building up of the breaking down process caused by traffic tear and wear, effects of elements and time. It covers a broad field, embracing in its scope the roadbed, track, bridges, waterways, fences, buildings, water supply and kindred work. The track structure, as it is called, embraces the roadbed as well as the rails and ties, necessitating variety equipment.

THE roadbed and track of a railway is one of the most important parts of the complete railway structure, and may, on account of its importance, be called the backbone of the system. To keep it in good condition, the railway must provide a certain sum of money each year, have a stock of material, and a trained organization of men.

The present day tendency in Canadian railway practice is toward the large car and the long train, and, as Canada is a country of long distances, this tendency will grow. Large cars and long trains require big engines to haul them, and big engines mean more wear and tear on the track. This condition is manifesting itself at a time when material is high in price and hard to get hold of; when labor is scarce and independent in attitude; when operating costs are growing in volume; while rates, both freight and passenger, remain almost stationary. Yet the Canadian railways must have and maintain good tracks if passengers and freight are to be carried safely and expeditiously.

The railway maintenance men of Canada, in common with those of the rest of the continent of North America, are to-day facing three important problems. They are—

First.—Stronger and more permanent track.

Second.—The obtaining and holding of labor.

Third.—The more economic use of material and labor.

The first may be maintained in a degree by better drainage, both of the surface and under type; ballast of a better grade, and more of it; heavier tie plates of the shoulder type, and the more extensive use of treated ties.

The Track Feature

Should you ask a maintenance man what he thinks of the importance of track drainage, he will concede you right off that it is one of the most important matters there is, and nine times out of ten he will tell you that the farther you keep the water away from the sub-grade the better the track will be. He generally recognizes water as an enemy to be feared and guarded against, all as a matter of theory. As a matter of practice, track drainage gets secondary consideration. There are a good many reasons for this. When the extra forces are put on in the spring there is great anxiety to get the ties in, the new rail laid, and the track surfaced, because the men higher up know about these things, and take a natural interest in their completion. The side ditches and other drainage work, instead of receiving first attention in the spring, are left until the last. We go into the winter with nice clean side ditches, when there is little or no water running, and through the spring and summer with dirty ditches, when it rains the greater part of the time. All this time the drains are working the moisture down into the subgrade, and storing up trouble and extra expense for cold weather. My own opinion is that we should start in the first thing in the spring and carry the ditching work through the season until it freezes up, even if it is necessary to put one or two extra men on the section solely for this purpose.

A Special Machine

We could accomplish a lot more by designing special machines for this work. I have in mind a machine which should prove very useful, and save a lot of time and money as well as relieving the regular forces of this part of the work, and giving them additional time to devote to other work. The machine I have in mind is to be patterned in the lines of a trench excavator, so designed to cut a ditch to line and grade. The excavated material would be raised by the bucket belt and conveyed by another belt conveyor to an air dump car for easy dumping on the banks. Such a machine should be built under ten thousand dollars, and could be run by four or five men besides the train crew. It should prove a money and time saver, and would insure clean ditches and free drainage.

Mostly all Canadian railways have ditching machines, but they are of the heavy type, and are designed for the removal of solid material. Whatever work they do has to be supplemented by a certain amount of hand labor in cutting and sloping the side ditches after the ditching machine has finished working.

Ballast pits in the past have, in the majority of cases, been chosen more with a view to short haul and low cost in handling rather than to the desirability of the ballast. The result has been that a lot of fine dusty ballast has been put out, which has given us dusty track, and the money put into the venture has not proved a good investment. In the future we shall have to make a closer study of these things, and when it is not possible to obtain bank gravel of the right quality, resort to the use of broken stone or washed gravel. Ballast of this kind is bound to be high in cost, so that more care will have to be given to the stripping off of the dead material from the roadbed, so that there will be no chance of mixing it with the new ballast.

Shoulder tie plates have proved a money saver in lessening labor in holding track to gauge; and those with the canted rail seat have helped to prolong the life of the rails by adjusting the wearing surface of the railhead to conform more closely with the coning of the wheels. My own opinion is that we should lengthen the outside margin of the plate an extra inch to get more bearing on the outside, and to prevent the plate being shoved down into the tie by the crushing force of the loaded rails. This feature should prove a help on the inside of curves. The extra margin would, of course, increase the weight of the plate about three-quarters of a pound, and, no doubt, it would have to be thickened slightly to make it stiffer, on account of the increased length, making the increase in weight around a full pound. The extra cost at ordinary prices would amount to about two cents each, and at present prices about four cents each. Personally, I would favor a tie plate with shallow, blunt ribs, or a smooth bottom, rather than those with deep sharp ribs, as there is less danger of the wood fibre being cut into and destroyed by rot. With a more extensive use of treated ties, which must surely take place in the future, this feature will require close attention.

Treated Tie Superior

Time was when the cedar tie occupied the first place in Canadian railway tracks. It was chosen because it was low in price, easy to manufacture, and resisted rot for a longer time than other woods. Under heavy loads it has not lived up to the first impression it gave, and has given out in other ways. Time has shown that it is not so good as the harder woods for curved track, and without tie plate equipment it was very easily cut by the rail bases. This led the railways to cast around for a harder tie, and the result has been that you will see the harder woods, such as jack pine, tamarack and hemlock favored to-day, although the life in some respects is shorter. Oak ties are nearly out of the question in Canada, as the supply of native timber is too small, and the cost of importing too high. With the treated tie we can increase the lifetime to about 12 years, and bring into use varieties of wood which to-day cannot be used in the untreated state. The argument has been set forth that the treated tie showed such a small margin in saving over the untreated article that a drop of a cent or two in the price of a tie would wipe the saving out. This argument carries a

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good deal of weight with the "powers" that hand over the money, but my prediction is that the prospective future supply of ties will alter this viewpoint.

The Labor Problem

The second problem which is staring us in the face is the obtaining of labor; and the retention of it after it has been obtained is becoming a still more serious matter. It is the opinion in some quarters that wages may remain high after the war, and that there will be a scarcity of good labor. This is a reasonable view, and the prophets may be right. Be that as it may, we are sure to face a labor shortage for the next three or four years. The solution of the problem would, at the first glance, appear to be to go into the market and bid up to the price the other employees of labor are offering, and take our chance of getting men. However, there are some sceptical people who will tell you that you cannot make bricks without straw, that men are scarce, and that the few who are available are offered more attractive living conditions by other branches of industry. It is true that the manufacturer and the contractor have offered higher wages and more attractive living quarters to the men than the railways have, but we can overcome this in a degree by providing better living accommodation.

Railways with their commissary departments for the supply of their dining car services should be in a position to feed their men in a more substantial way and at a lower relative cost than they can do it themselves, or have it done for them by contractors. Better and more sanitary living quarters, combined with good food, will increase the efficiency of the worker and go a long way toward establishing a contented body of men willing to stay on the job until the work is finished. Railway maintenance work should appeal to the laborer on account of its variety and its outdoor environment.

In respect to labor, the railways should be as keen to obtain and hold men as the contractor or manufacturer. Railway maintenance work has not in the past been regarded with favor by the better class of men. If a quick improvement in the housing and feeding conditions can be effected, then a little work by the publicity department of the railways setting forth the attractions of railway maintenance work might work wonders. Railways buy a lot of advertising space in the daily papers, and a live advertisement once in a while, appealing to labor, would undoubtedly help. If we give our track laborers as good quarters as are enjoyed by the bridge and building men, we will have taken a long step in the right direction.

Conservation of Construction Material

So much has been said about the vast amount of money to be saved by the care, rehabilitation and the re-use of old material, especially by the magazine writers, that one is prone to approach the subject with fear and trembling. We can, however, by a freer use of the rail saw, treat our released rails to advantage and prolong their life in branch line service. My idea would be to do the sawing work in the winter season when the work is slack, maintaining a small gang for this purpose, or the work might be carried on throughout the entire year, if there were enough of it to justify it.

Take a year when main rail renewals were fairly heavy. The released rail could be sorted over, and after the main line repair rail had been set aside, the remainder could be gathered up and hauled in to the saw, there to be treated and laid in a branch track the next season. In this way we would get a pretty fair sample of branch line rail, and one calculated to last a good many years under light power. All bolts should be carefully wrenched off, oiled, packed in boxes, and set aside in the store's yard until the rail goes out to be laid. Angle bars and old tie plates should be similarly reserved to accompany the rail when laid.

A process for re-rolling worn rails into rails of slightly lighter section, with heads of an altered shape, both symmetrical and unsymmetrical, for use on branch lines, has been patented in the United States, and several of the prominent railways over there have had some of their rails treated in this manner. In the majority of cases the alteration to the rail is so slight that the old fastenings can be re-used. Briefly, the process consists of a re-shaping of the worn head. This process is worth looking into.

We can make better use of our engine cinders than we have in the past, by spreading them on the sides of new cuts and banks, where vegetation is slow to start, and the material slides. Cinders will prevent sliding to a considerable extent, and are useful in keeping down the dust. They make good ballast in rock cuts, and in other places where rails batter because of a hard unyielding sub-grade.

There is an extensive field for the introduction of motor-driven section cars to convey section crews to and from their work. The time saved in pumping a hand car will, under the right kind of foreman, be used to the railway's advantage in increasing the day's output of work. Having employed the man, it is essential that he be kept working profitably and effectively during the hours of work. If a gain of one hour per day can be made in the time of each man employed on track, there will be a gain of about 10 per cent. in the amount of work performed, which will benefit the track to that extent.

The future will see a more extended use of labor saving machinery in all branches of maintenance-of-way work.

MUST ECONOMIZE IN COAL

AN intimation that both Canada and the United States might have to be placed on "coal rations" was contained in a statement upon the fuel situation which Sir George Foster made in the House of Commons at Ottawa on Aug. 22, in reply to a question by W. E. Knowles, of Moose Jaw. This course might be necessary, the Minister of Trade and Commerce said, so as to distinguish between absolute necessary services and those not so necessary. Further, he stated a distinct call would have to be made to all interests to save coal just as food was being saved.

The Minister of Trade and Commerce said the production of non-anthracite coal in Canada last year was 13,800,000 tons. Of this over 6,000,000 tons came from the Maritime Provinces, chiefly Nova Scotia; 2,800,000 tons from British Columbia, 4,600,000 tons from Alberta, and a small quantity from Saskatchewan. This was not sufficient to meet the country's needs, and about 13,000,000 tons of bituminous coal had been imported from the United States. This represented the consumption with the exception of some 1,800,000 tons exported as bunker coal.

Import All Anthracite

As regards anthracite, Canada was entirely dependent upon the United States. Last year 4,500,000 tons of anthracite had been imported into Canada, 250,000 to the Maritime Provinces, 2,000,000 to Quebec, 2,000,000 to Ontario, and about half a million to Manitoba.

The total importation of fuel coal for domestic and industrial purposes was 17,500,000 tons, but stocks of anthracite in Canada were down about a million tons, which meant that for next year we were dependent upon the United States for 18,000,000 tons of coal.

As to the Canadian coal situation, Sir George could see no possibility of increasing the amount mined. There had been strikes and delays in the West, which had decreased the possible output, while in Nova Scotia the output had been decreased by shortage of labor due to enlistment and other causes. On the other hand, the war caused a very great increase in consumption in the Maritime Provinces. As a result coal which would in the ordinary way have gone to Quebec Province, from the Maritime Provinces would now be used there, and Quebec Province would have to import from the United States.

U. S. Coal Production

In the United States the normal production was 67,000,000 tons of anthracite, and last year the production was 509,000,000 tons of bituminous. As to the high prices and fear of shortage, Sir George said the war had caused a vast increase in coal consumption for industrial purposes, steel alone accounting for 40,000,000 tons. This had reacted on the railways, which were requiring 30 per cent. more for haulage than last year, which meant another 40,000,000 tons. In addition there had been a shortage of land haulage, while there was a shortage of water transport on the lakes due to the fact that war conditions had caused vessels to turn to more lucrative traffic.

There was need for co-ordinating the coal dealers and jobbers in Canada with a view to quick distribution of the coal when it arrived in Canada, and making arrangements for the supply, while on

the other side the work of the Fuel Controller was to keep in touch with miners, transportation and so on, so as to secure adequate production.

"With present activities," said Sir George, "it is not impossible that both the United States and Canada will have to be put on coal rations so as to distinguish between absolutely necessary services and those not so necessary.

GAS EXPLOSIONS IN BOILER FURNACES.

WHEN certain conditions are fulfilled in a boiler furnace, a gas explosion of greater or less intensity will occur. For every explosion of this kind that causes material damage, there is doubtless a large number that are so unimportant that they entirely escape notice; but the fact that they do occur is well known to all persons who are familiar with the operation of steam boilers. These explosions are common to all types of boilers, and the method of setting the boilers over their furnaces appears to have little to do with the frequency or severity of them. In a general way it may be said, also, that the kind of fuel used is not the determining factor. Explosions of the gases distilled off from coal are frequent, and accidents of the same kind are far from uncommon in connection with the use of oil and natural gas for fuel. Occasionally, too, wood waste or other similarly bulky fuel which is likely to gasify rapidly is known to produce explosive gas. These explosions are likely to continue so long as fuel is burned in confined spaces such as boiler furnaces, as it is practically impossible to eliminate them entirely. It is feasible, however, to minimize the danger from them to a large extent.

Coal Burning Furnaces.

Coal being the most commonly used fuel, it follows that the greater number of explosions occur in coal-burning furnaces. The furnaces of heating apparatus are practically immune from such accidents, however, because the conditions under which they are operated are usually quite different from those that obtain in power-generating equipment, and for the further reason that, except perhaps in installations of large size, it is common to use anthracite for heating purposes, and this produces little gas as compared with bituminous coal. We recall one case, however, in which serious damage was done to a cast-iron sectional heating boiler and to the surrounding property by a gas explosion in the furnace. In this particular instance coke was the fuel used, and the explosion was so violent that the boiler was almost totally demolished, and serious personal injury would certainly have resulted also, if anybody had been in the vicinity at the time.

Gas explosions in coal-burning furnaces are chiefly due to the incomplete combustion of the fuel on the grates and of the gases in the combustion chamber, owing to an insufficient air supply. In the combustion of coal, carbon—its chief constituent — combines with the oxygen of the air which is drawn up through the grates, with the ultimate formation of a considerable quantity of carbon monoxide gas, CO, and this, when sufficiently heated, has a strong affinity for additional oxygen. Under proper operating conditions, and with an adequate supply of air, the carbon monoxide is quietly burned to carbon dioxide CO_2 in the combustion chamber, and the danger of explosion is then past. If the air is not provided in sufficient quantity, however, there will not be enough oxygen to convert the monoxide immediately into carbon dioxide; and when this condition prevails, the unconsumed but inflammable monoxide gas passes along through the furnace, combustion chamber, and tubes, and eventually up the stack still unburned.

If a considerable amount of air is admitted through the fire-doors or elsewhere above the level of the fuel bed in the furnace, the carbon monoxide in the furnace will burn quietly if the proper temperature prevails in the furnace. If, on the other hand, the temperature in the furnace is low and the fuel bed is covered with fresh coal so that immediate ignition of the gas is not assured as the air enters the furnace, then the entering air will mix with the inflammable monoxide gas, and what happens after this depends upon a number of factors. If the mixture so produced is such that the proportion of carbon monoxide to oxygen is greater or less than certain limiting percentages, then no explosion, in the true sense of the word, can occur, even upon the application of flame. There is, however, a certain critical range of proportions that the mixture may have, such that a quite serious explosion may occur if the gas is present in any considerable amount, and is fired in any way. The firing may be accomplished by stirring up the fuel bed on the grates, or by a tongue of flame coming up through black coal by which the incandescent part of the fire has been blanketed or smothered, or in other ways.

If the circulation of gases through the furnace is brisk, there is little or no chance of a gas explosion; but when the circulation has been checked by closing the damper, or throwing on large quantities of fresh coal, or in any other way, pockets of explosive gas may accumulate in the setting, and these may later give rise to an accident.

In the event of a serious explosion, the least that can be expected is that the fire-doors will be blown open and the burning fuel thrown out into the boiler-room, with the possibility of setting fire to the building. In addition, any person who may be in front of the boiler at the time is likely to be severely and perhaps fatally injured. The probability of more extensive property damage is not remote, and the boiler front and setting, and parts of the building, may show the effects of the explosion. In severe cases, too, the shock produced by the gas explosion may cause one or more of the boilers to burst. Many of the "mysterious" explosions that have occurred have very likely been due to such a cause, and in some cases it has been demonstrated that exceedingly serious explosions have been produced in this way.

Precautions Against Explosions.

To prevent such explosions, or to minimize the danger from them, it is important to regulate the air supply in such a way that complete combustion of the fuel and of the gases derived from it will take place when operating conditions are normal, and to assist the combustion or to remove the gases in a safe manner when unusual conditions prevail.

Normally, with a well-designed boiler installation, the draft, either natural or artificial, prevents the accumulation of pockets of explosive gases, but the danger arises when this circulation is checked by banking the fires, or by running them low when only a small amount of steam is required. At such times, therefore, special caution is necessary. Careful preparation of the fires is important, before banking them. Clean the fires and remove the ashes a short time before shutting down the boilers, and then allow the fires to burn up evenly over the entire surface of the grates, seeing that the fuel bed is leveled to an approximately uniform thickness. Next apply the banking fuel, taking care that this is also spread on uniformly and in sufficient quantity.

As a rule, the dampers in the uptakes of boilers are perforated or slotted so that there will be a slight draft through them even when they are in the "fully-closed" position. If such provision is lacking, however, the dampers should be left partly open, and usually the explosive gases will then pass out through the chimney, because they are somewhat lighter than the air, and are first to feel the influence of the draft. Under certain conditions, these gases may be by-passed to the stack, and if the by-passes are correctly proportioned the loss in boiler efficiency, even under operating conditions, will be inconsequential. A by-pass of this kind is particularly important in connection with a boiler in which the gases between the combustion chamber and the stack follow a downward direction during any part of their travel.

As a further safety measure, the dampers and fire-doors should be opened in the morning before the fires are broken up, so that any gases that may have accumulated during the night will be swept out of the setting and into the chimney.

Safety fire-doors have been designed for the protection of the firemen and others against the showers of burning fuel that are sometimes projected from the furnaces by gas explosions. In some types the doors slide in guides, sidewise or vertically, instead of swinging on hinges. Sometimes, too, the doors are hinged so that they swing into the furnace, instead of outwardly into the fire-room; and in other cases ordinary doors are provided with special safety catches.

A practical device of some one of these types is recommended for use in cases where gas explosions are common.

Oil or Gas Fuel Furnaces

The likelihood of having gas explosions is especially pronounced when either oil or gas is used for fuel, unless the fireman is an exceedingly careful person. In lighting the fire in such cases, burning cotton waste or a burning torch or some other kind should be placed in the furnace before the fuel-supply valve is opened. In this way the fuel will be ignited at once, and before any explosive vapors or gases can accumulate in the furnace. If a burner should become extinguished (or "snap out"), while the boiler is in operation, because of water in the oil, or on account of temporary stoppage of the fuel supply, or for any other reason the supply valve should be closed at once; and the furnace and all of the gas passages should be ventilated thoroughly before again lighting the fire.

Various special precautions against gas explosions may be required when forced or induced draft is employed, and in such cases the judgment and skill of the engineer in charge may be severely taxed to provide a remedy without sacrificing something of the efficiency of the boiler, because in boilers of ordinary design the maximum efficiency is usually obtained with a comparatively low velocity of the products of combustion, while the prevention of gas explosions depends largely upon maintaining a fairly rapid circulation. A way may usually be found to overcome these difficulties, however, and safety demands that earnest and consistent efforts be made to arrive at a proper solution of the problem.

USE OF DISTILLED WATER IN ACCUMULATORS

By L. E.

FROM the first days when accumulators were first invented there have been many scientists who have devoted their attention to the liquids to be used when recharging, and needless to say in those days many combinations of chemicals were used, and with more or less good effect. Of course, when first charging an accumulator sulphuric acid of special purity and made from Sicilian brimstone and of about 1190 specific gravity is used, and after discharging has reached the amperage capacity of the cells that the engineer in charge considers they should be reduced to, they need recharging.

The combination of acids for recharging was not altogether satisfactory in the early days of electrical storage batteries, and the happy idea of filling up with water was hit upon, with much better results, but later scientific practice has recommended—almost insisted upon—the use of distilled water, and for this purpose, the distillation must be thoroughly done. It is used after practically every charge for "topping up," i.e., the covering of the plates in the accumulator to a certain height in the cell specified by the makers of the battery installed, and whose directions should in every case be followed,—in order to take the place of the acid evaporated and gassing of cells when fully charged. Distilled water materially assists in bringing up the specific gravity of the liquid in which the plates are immersed to the proper working standard, and further, as is well known, the ordinary water which is available from the public supply is by no means pure. It contains not only impurities of a chemical nature, such as lime and other salts, but of a mineral nature as well, and owing to the formation of the earth geologically, the greater part of the mineral in the water is iron, and even that is not in a strictly pure state. In fact it is in a very impure state and almost as soon as this ordinary water, with its tendency to impurities enters the accumulater chemical reaction is set up, and as the iron is in the predominant position, the action on the lead plates leads to sulphuration, which immediately impairs their working capacity and later on ruins them. Often enough there are impurities in the sulphuric acid is impure unless it is purchased under a guarantee.

Distillation Avoids Buckling

Distillation of the water extracts the iron properties from it and thus the life of the accumulator is lengthened and to a certain extent the tendency, which is always present in the plates to "buckle" is considerably minimized. This liability to buckle, and which is assisted in every way by the "sulphating" caused by the public water supply, is one of the most serious happenings to an accumulator should there be a sudden demand upon it, or should the load be suddenly increased. In fact the consequences of using ordinary water, as supplied from the main, are serious and in many cases where a worker has not wished to be bothered with the trouble of distilling the supply, accidents, which could have been avoided have occurred, and, in many cases, with disastrous consequences. Distilled water considerably minimizes the risk of "sulphuretting" though it does not entirely cure it . A flexible rubber tube or special acid proof pump should be kept in the accumulator room for filling and emptying the cells.

The first charge of an accumulator will last for from 40 to 50 hours and the recharging with distilled water raises the specific gravity up to the proper working amount, when fully charged of about 1208.

A practical man, mindful of the life of the accumulator and the service he can get out of it will not hesitate to doubly distill the water he proposes to use, and in some cases of supercarefulness some resident engineers demand a chemical and mineral analysis of the water before they proceed to distillation, so that as much of the harmful impurities can be eliminated as possible. Carelessness, in this, as in other engineering work, only leads to trouble and expense, and if an accumulator is valued, it should be properly taken care of, and given the correct materials on which it can perform its work efficiently and for a proper length of time.

THE COST AND USES OF MAGNESIUM

By C. I.

PRIOR to the war only small quantities of magnesium had been manufactured, mainly for the purpose of flash-light photography and fireworks, but also, to a small extent, for use as a deoxidiser in the casting of monel metal, nickel and steel, but with the war an unprecedented demand sprang up. Magnesium does not enter into explosives nor into arms as an integral part, but small quantities are put into shrapnel shells so that observers and gunners may know exactly where the shells are bursting. By day the burning magnesium gives a pure white cloud of magnesium oxide that can readily be seen, and at night it gives a dazzling white light. Larger quantities are used in aerial bombs and rockets used for lighting up the country at night. During 1915 the manufacture of magnesium was begun by five American and one Canadian firms.

The magnesium is collected from the electrolyte, remelted and moulded into both round and square sticks, from five-eighths of an inch to 2 in. thick, and from 14 in. to 18 in. long. Some of the product is sold as powder for flash-lights and some in the form of a coarser powder for use in shells. Magnesium for flashlights must be very pure and processes have been devised giving a purity of 99.5 per cent. or more. Before the war magnesium was quoted at about $1.62 per pound in England for the imported material, and after the cutting off of the last foreign supply the price rose to considerably over $5 or even $6 per pound for sticks and of course prices are still soaring. So far as can be seen any increase in the magnesium industry will depend mostly on the discovery of new profitable or desirable uses to which it may be put, but it is generally recognized that prices must decrease to about $1 per pound before peaceful uses will greatly increase.

The properties of magnesium and especially of its alloys are not yet well enough known to say for what purposes it may prove useful. It has not been found of such use as a direct metal, but magnalium — an alloy of aluminum, containing 2 per cent. or less of magnesium and small percentages of other metals—is said to be used in automobiles and in aeroplanes.

"I spent the first part of my vacation on a motorcycle."

"And in what hospital did you spend the last part?"

High Pressure Air Compressor Design and Application*

By Joseph M. Ford

Compressed air at high pressure is becoming an increasingly important medium in modern engineering practice and in naval warfare. The accompanying paper deals with the machines which produce high pressure air, leaving on one side the question of power transmission by compressed air. In passing, the principal advantages of this system are referred to, and will be seen to be of considerable value. They consist of the facility with which energy can be stored; the unlimited rate at which accumulated energy may be converted into useful work; and, apart from loss of efficiency, leakage cannot cause any awkward consequences.

TESTING MULTI-STAGE COMPRESSORS

ALTHOUGH extremely interesting results can be obtained from scientific tests of air-compressors, the manufacturer is usually content with tests for the efficiency of the machine. A purchaser requires to know the power required per cubic foot of air actually delivered, since this is the basis of comparison for compressors. The problem, then, is to determine exactly how much air is being delivered. The two methods usually adopted are: the "pumping-up" method and the orifice test. In the former the compressor is run at its full pressure, pumping into a reservoir, and from this latter the air is led to a receiver of known capacity. The details of the method are well known, being exactly the same in principle as used on tests of ordinary compressors for pneumatic tools. The orifice test is now being largely adopted, on account of the possibilities of error with the "pumping-up" method due to inaccurate temperature readings, oil and water in the bottles, etc. The orifice test method is also well known in connection with ordinary compressor work and need not be described.

Useful information as to the condition of piston rings and valves may be obtained from indicator cards, which also show to some extent the efficiency of the cooling. If, on applying Brauer's construction to the diagram, the compression line is found to be almost isothermal, it does not necessarily indicate that the cooling is almost perfect, as is sometimes stated. The line may indeed appear to be the isothermal, due almost certainly to leaky piston rings or suction valves. Lines giving an exponent value in PVn of less than 1.26 should be looked upon with suspicion.

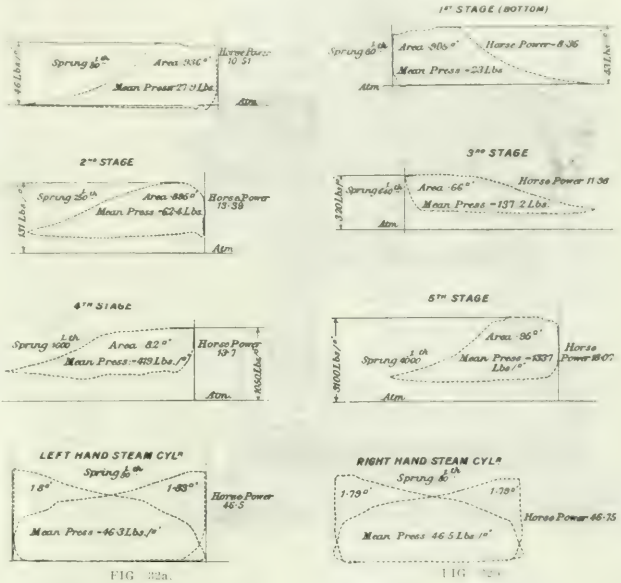


FIG. 32a.

If any stage pressure is very much above that estimated, the trouble will likely be due to the valves of the next higher stage leaking, or to its own delivery valve not being tight. Judicious use of the cylinder drain cocks, and the behavior of the stage pressure gauges immediately on shutting down, enables conclusions to be drawn as to the source of trouble without the necessity of taking indicator cards.

Maintenance of Compressors

The usual practices of engine maintenance apply to compressors, but unfortunately the care and attention given to these machines is frequently less than that necessary. Particularly is this the case in some Diesel engine plants, where the compressor, until it gives trouble, is looked upon as an engine detail. The lubricating system, above all, must be kept in the highest state of efficiency, as failure in, say, the high-pressure stage, where these is usually considerable ring friction, generally leads to a cracked

*Conclusion of paper read before the Greenock (Scotland) Association of Shipbuilders and Engineers. See issues of May 31 and 28 for previous instalments.

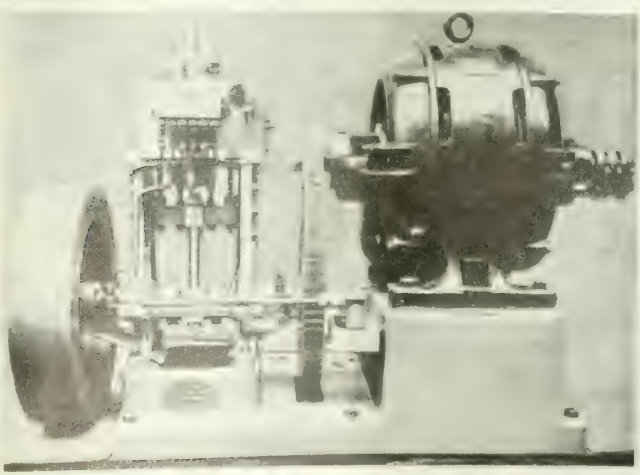


FIG. [illegible] COMPRESSOR, 600 CU. FT. CAPACITY

cylinder, which may not be the limit of the damage.

When the circulating water is chalky or muddy, the cooling system must be periodically cleaned if the highest efficiency is to be maintained. Valves should be examined from time to time for cracks. It is of the utmost importance that relief valves should be in perfect order, for these are in every way as important as a boiler safety valve, and under no conditions whatever should the valves be wedged or otherwise put out of operation to stop a leak. They should be tested for blowing off at frequent intervals. If stage pressures are rather higher than normal, it means probably, as previously explained, that valves are leaking.

Provided the pressures are not excessive, no trouble will result from running in this condition, but matters should be put right at the first opportunity. In justice to Diesel engine air-compressors, it must be stated that the frequency with which the engine log book records "compressor trouble" is due in many cases to negligence. There is still a big scope for improvement in the design of multi-stage compressors.

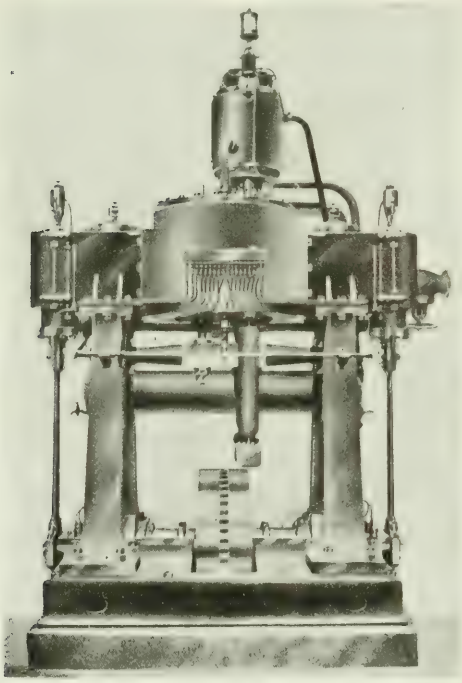


FIG. 31. "BROTHERHOOD" FIVE-STAGE COMPRESSOR. 10,000 CU. FT. CAPACITY.

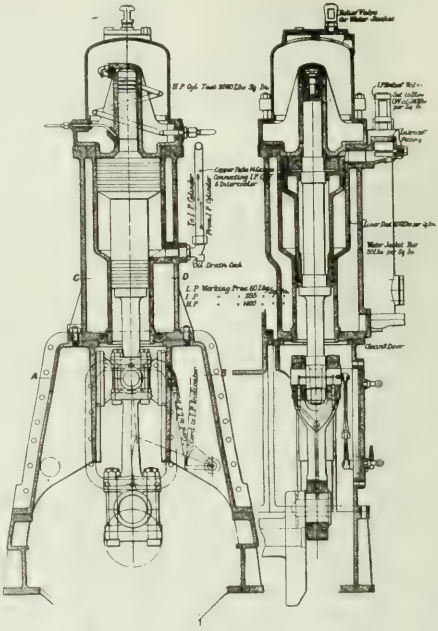


FIG. 35.

FIG. 36.

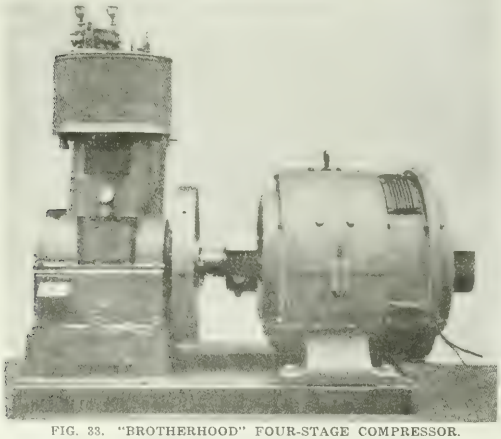


FIG. 33. "BROTHERHOOD" FOUR-STAGE COMPRESSOR.

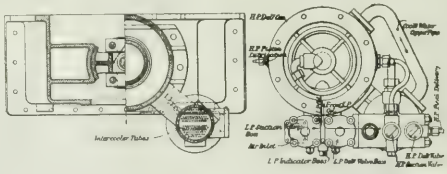


FIG. 37

FIG. 38.

Modern Machines

Through the courtesy of various makers it has been possible to reproduce several photographs and drawings of some of the latest high-pressure air-compressors, and a glance at these will show at once the divergence which exists in design.

Fig. 30 shows a small three-stage compressor, chain-driven, and having a capacity of 600 cubic feet of free air per hour, compressed to 3,000 lb. per square inch. As has been already explained, in small machines the tendency is to reduce the number of stages of compression for a given final pressure, and this statement is borne out by a comparison between this machine and that shown in Fig. 31. Although the working pressure of this latter is the same, viz., 3,000 lb. per sq. inch, the capacity is 10,000 cub. ft. free air per hour, or more than 16 times as great as that of the small machine, and in this case the compression is divided into five stages. The machine is steam-driven, two double-acting steam cylinders being at the ends and the air cylinders in the centre, while the air piston rods are coupled side by side to the horizontal bridle which is attached at its extremi- to the steam line crossheads.

A [illegible] of indicator diagrams from this machine is given in Figs. 32 A and B. It may be mentioned that the shape of the suction lines in the cards from the fourth and fifth stages results from the fact that the cylinder volumes are fairly large compared with the cubical contents of the intercoolers, the lowest point on the line indicating the commencement of transfer. The comparatively small clearance volume in the first stage cylinders, shown by the rapid drop in pressure on the back stroke, is also worthy of note, the reasons for the small volume having previously been discussed.

Fig. 33 shows a four-stage direct-coupled machine by the same builders, capable of charging a 45 cub. ft. reservoir to 2,000 lb. per sq. inch in 80 minutes when running at 250 r.p.m., whilst the five-stage direct-coupled machine shown in Fig. 34, charges a 40 cub. ft. receiver to 3,000 lb. per sq. inch in one hour at 350 r.p.m.

A point to which attention may be directed is that the intercoolers on these machines are generally of the submerged type, that is, the cooler consists of a copper or steel pipe coiled round the cylinders in the tank. This tank construction simplifies very considerably the cylinder castings, and the cooling effect is probably enhanced due to the whole of the connections being submerged, but of course this method is not always admissible. The cooling is still further improved by water injection, the water in the case of a steam-driven machine being obtained by condensation, and therefore quite free from foreign matter.

The piston packing in these compressors is of the fibre-ring type, the high-pressure gland fibres being fitted in removable boxes, which can be repacked at the bench—an obvious advantage. All valves, which are mainly of the thimble type, have removable seatings, so that a replacement is readily effected.

An unusual feature is the provision of an indicator to show that the circulating water is flowing through the casing, which in many cases is very convenient as it is not always easy to arrange for the water to be discharged into a funnel. The importance of maintaining the circulation will be readily understood from a study of the temperature charts previously given.

Diesel Engine Compressors

Special attention has been devoted to the design of air-compressors for Diesel engines; product of one firm ranging from small hand-driven machines for charging starting bottles in case of emergency, to those used on some of the largest machines yet constructed. A patented design of three-stage compressor for 1,000 lb. per sq. in. working pressure, which has given very satisfactory results from marine work, is shown in Figs. 35 to 38, a special feature of this machine being the arrangement of the second or intermediate stage. By suitably proportioning the cylinder and intercooler dimensions it is possible to dispense entirely with valves in this stage, which means that the intercooler volume is part of the intermediate pressure cylinder clearance.

The principle will perhaps be better understood by reference to Figs. 39 and 40, which shows the "Reavell" patent V class duplex compressor. The air is delivered from the low-pressure stage down through the intercooler to the second stage cylinder, and on the down stroke it is compressed, and again passes up through the same intercooler on its way to the high-pressure cylinder—the high-pressure suction pipe being in direct connection with the low-pressure delivery passage. The only modification to the low-pressure valves which this entails is that the valve cover must be arranged to withstand the intermediate pressure delivery pressure instead of the low-pressure as is usual.

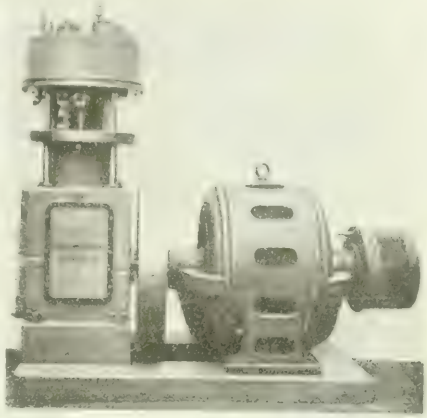


FIG. 34. "BROTHERHOOD" FIVE-STAGE COMPRESSOR.

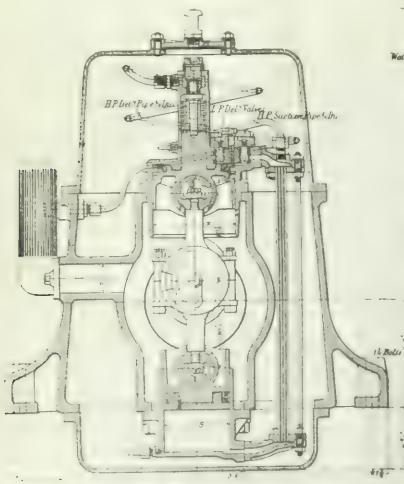


FIG. 39.

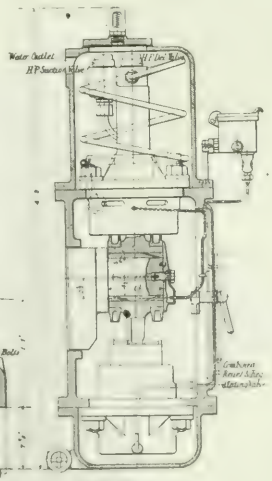


FIG. 40.

Since the air passes through the same intercooler twice, only one of these is required, instead of two as with other designs, and apart from the simplicity of construction resulting therefrom, the efficiency is considerably increased owing to the fact that the second stage of compression is effected in the cylinder and cooler itself—the reasons for improved efficiency having already been dealt with. The marine compressor under consideration is exactly the same in principle, only a single intercooler being provided.

In the remarks on cylinder clearance volume, it was pointed out that in a Diesel engine compressor it is sometimes advantageous to have considerable cylinder clearances, and this is borne out by a study of this machine. The clearance volume in the low-pressure stage is, of course, reduced as far as possible, the method of securing the piston to the rod being such that the clearance space is the minimum. The intermediate-pressure clearance, however, is very large, being, in fact, the whole volume of the intercooler tubes and connecting pipe; whilst the high-pressure clearance is also very large, being the volume of the coiled aftercooler in the jacket. Apart from the features which have already been dealt with in the notes on clearance, this arrangement allows the high-pressure valves to be located outside the water jacket—a distinct advantage—but, further, the air is cooled to a large extent after compression before it cooled to a large extent after compression before it reaches the delivery valve, which cooling undoubtedly lengthens the life of the

latter and reduces carbonization troubles. The theoretical indicator diagram which results from these large clearances and "valveless intermediate" construction is given in Fig. 54, annexed, and applies to all machines of this type.

As far as the actual construction of the machine is concerned, attention may be called to the very effective cylinder jacketing, especially at the breech end of the low-pressure cylinder; also the simplicity of the high-pressure cylinder casting, with its absence of valve pockets, should be noted. It might be noted that one small point which is open to criticism is the method of making the air connection between the jacket and the liner—viz., by the forced-in sleeves, for should a liner by any chance become scored or cracked, it might prove a little difficult to remove the sleeves so as to permit the withdrawal of the liner. This compressor is driven from the forward end of the engine crank shaft, and the stage pressures adopted in this case are: low pressure 60 lb. per sq. inch, and intermediate pressure 295 lb. per sq. inch, when working at its full capacity against a final delivery pressure of 1,000 lb. per sq. inch.

In modern high-power marine Diesel engines of the two-cycle slow-running type, it has become usual, for various reasons, to drive the scavenging pumps by means of levers, in accordance with the well-known marine practice, and in many cases the compressor drive can conveniently be arranged in conjunction therewith.

FIG. 42.

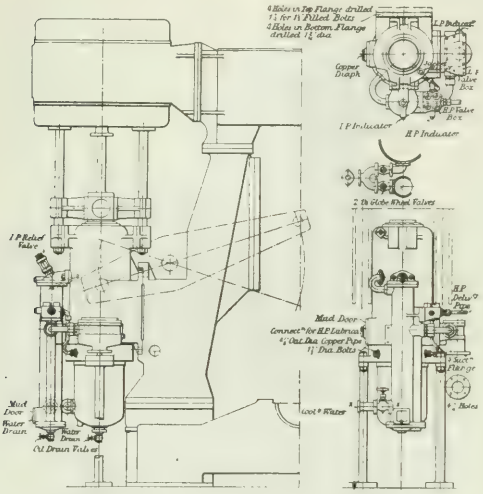


FIG. 41. FIG. 43.

FIG. 46.

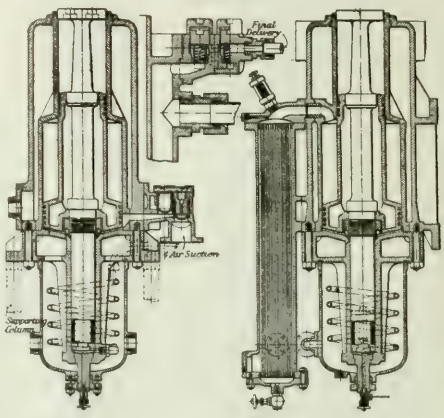


FIG. 45. FIG. 47.

FIG. 48. FIG. 49.

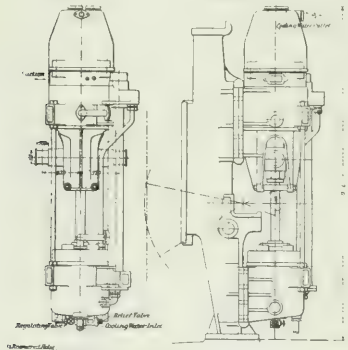
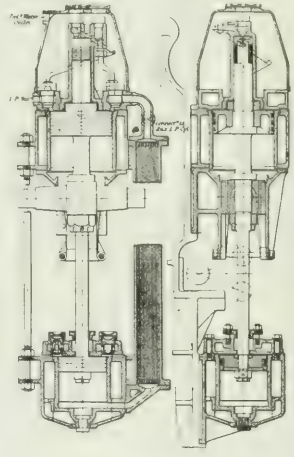


FIG. 50. FIG. 51.

FIG. 52. FIG. 53.



Figs. 41 to 44 show the compressor arrangement which has been successfully adopted on a large British marine engine, whilst sections of the machine itself are given in Figs. 45 to 47. This compressor also embodies the Reavell "Valveless intermediate" patents, the direct passage between the intermediate-pressure cylinder and the intercooler being clearly shown in Fig. 46. The simple construction of the intercooler is worth noticing, the tubes, which are usually of copper, being expanded into the steel tube plates. When the thickness of the latter, gauge of the tubes, and method of expanding are carefully chosen, this system leaves little to be desired, and, further, it permits of a greater cooling surface being obtained, for the same overall dimensions, than would be the case were the usual ferrule system adopted. However, the tubes must be of the highest quality material and must be thoroughly tested before use, for should a tube failure occur, it would be more difficult to repair than in the case of a cooler with ferrules.

The valve arrangements are seen in Figs. 45 and 47, the low-pressure suction and delivery valves being interchangeable, whilst the high-pressure valves, which have removable seats, are also interchangeable. This, of course, reduces the number of spares which have to be carried, in addition to obviating the possibility of mistakes when reassembling after an overhaul.

To minimize the danger, should the high-pressure cooling pipe or any other part under pressure give out, three large bursting diaphragms are provided on the water jacket (two being on the high-pressure bonnet, and one on the opposite side of the low-pressure valve box); these are ruptured, thus giving free egress to the water and air, when the pressure in the jacket exceeds a pre-determined figure. It may be remarked that the arrangement of this compressor, with the high-pressure cylinder at the bottom, is unusual, and to avoid difficulties which might otherwise result from accumu-

lated oil in the latter, special provision is made for draining.

Another lever-driven compressor as used on engines of continental design, is shown in Figs. 48 to 53, and, as in the previous machines, there are no valves in the second stage. In this case the intermediate-pressure cylinder is located below the crosshead, and a patented

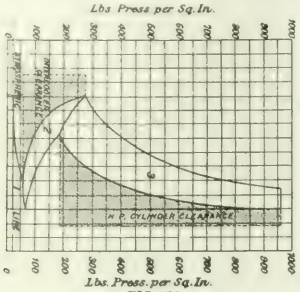


FIG. 54.

feature is the utilization of the end of this cylinder as an auxiliary low-pressure cylinder. Normally the valves in the cover of this cylinder are inoperative, but when there is considerable manoeuvring, and in consequence a big demand for air, such as obtains on entering port, they can be brought into action, either automatically or by hand, when, as will be seen from the sections, this cylinder delivers air into the top of the intercooler at the same time as the main low-pressure cylinder, the whole then passing to the intermediate cylinder in the usual way. By this simple means, the capacity of the compressor can temporarily be increased by about 30 per cent., which means that it will not be necessary to keep such a large auxiliary machine running as would otherwise be the case. As would be expected, very special attention has to be paid to the proportioning of such a machine, on account of the alteration to the distribution of the total work which results from such a device. In this particular machine the high-pressure valves are arranged directly in the cylinder head, access to them being obtained from the engine upper platform through the small covers on the bonnet.

Fig. 55 shows a well-designed machine of a type similar to those used for torpedo work, for a delivery pressure of 3,500 lb. per sq. inch. The capacity at this pressure and 340 r.p.m. is 30 cub. ft. of free air per hour. The machine is a four-stage steam-driven type and is a self-contained unit, the inverted steam cylinder, as will be seen, being placed beneath the air cylinders. Apart from the very compact arrangement which is thus obtained, the drive is direct, so that the stresses in the connecting rods, for example, are much less than they would be with the "side-by-side" arrangement. Another noteworthy feature in the design is the provision of a separate cylinder for each stage of compression, instead of having recourse to differential pistons, which latter arrangement, although possessing many advantages, is decidedly inferior from a thermal point

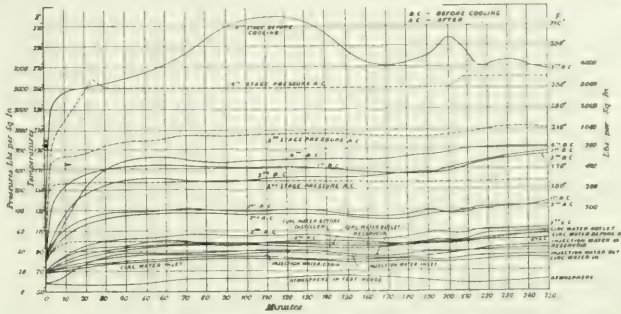


FIG. 57. CURVES OF TEMPERATURES AND PRESSURES.

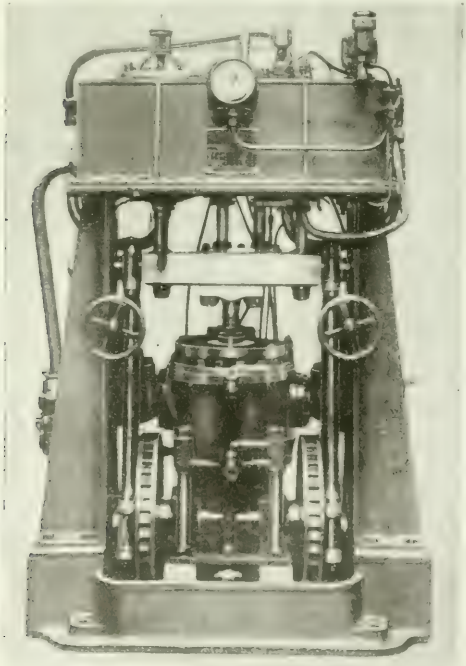


FIG. 55. "GENERAL" FOUR-STAGE COMPRESSOR.

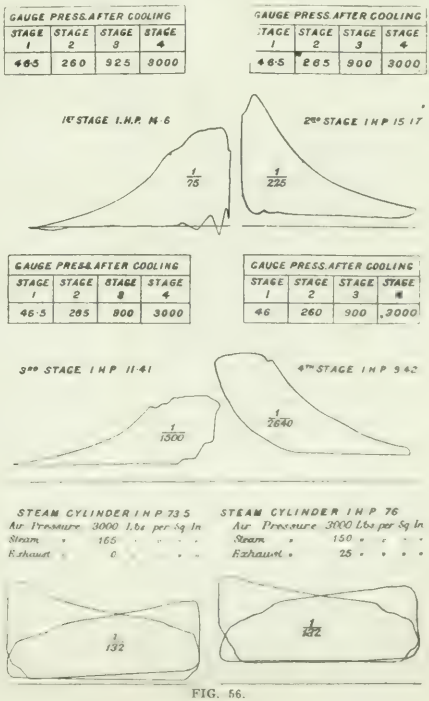


FIG. 56.

of view, on account of the reduced cooling surface per unit of heat generated. In addition to the effective cooling resulting from the arrangement adopted, intercoolers are provided, and, further, a distiller is fitted which provides pure water for injection into the air cylinderss.

Figs. 56 and 57 and the table show the results of an exhaustive trial carried out by the builders on one of these machines. The curves reveal many points of interest, whilst an idea of the distribution of work through the machine can be obtained from the cards, which show a mechanical efficiency of about 68 per cent.—a very satisfactory result considering the large amount of piston friction and the

EXPLOSIVES FROM THE ATMOSPHERE

GERMAN scientists are now producing nitric acid from the air. This has been done in Norway and Switzerland for some years, and it is proposed to establish a factory in Manchester for the same purpose.

Glycerin is one of the main articles in the manufacture of a universally used explosive; and as glycerin is obtained entirely from oils and fats, of which articles Germany must now be entirely devoid, this fact will perhaps throw some light on the fact that the Germans are looking after their dead very well.

A well-known professor of chemistry

shock or blow, undergoes chemical changes in itself, and this chemical change takes place so rapidly and with the production of so much gas, that obstructions in the way of gases produced are simply forced out of the way and we get what we call an explosion.

Some substances are much more powerful explosives than others, and some are so explosive that they cannot even be touched with a feather. Under these limitations we use those which we can handle and harness up for use with safety to ourselves.

There are three great classes of explosives used in warfare—high explosives, propellants, detonators.

AIR-COMPRESSOR TRIAL, JANUARY 11, 1915; ENGINE No. 539. BY THE GENERAL ENGINE AND BOILER CO. NEW CROSS, LONDON

Gauge Pressures after Cooling				Boiler Pressure.	Back Pressure.	Counter		Air Inlet Atmosphere.	First Stage before Cool.	First Stage After	Second Stage Before.	Second Stage After.	Third Stage Before.	Third Stage After	Fourth Stage Before.	Fourth Stage After.	Circulating Water Inlet	Circulating water before Distiller.	Circulating Water Outlet.	Injection Water Inlet.	Injection Water Drain	Pressure.
Stage 1	Stage 2	Stage 3	Stage 4			Revs.	Time, Mins.															
												Pump Up.										
								deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.	deg. F.
12	248	500	500	155	6	1,020	3-0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	252	580	1,000	150	7.5	2,380	7-0	57	156	109	250	101	122	83	95	78	68	81	82	78	78	60
16	260	580	1,500	150	8	3,680	11-0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	262	581	2,000	150	8	4,850	14-25	56	162	116	250	104	135	88	130	81	74	82	86	78	78	73
18	270	600	2,500	150	9	5,980	17-45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
49	280	640	3,000	155	10	7,040	20-40	56	165	124	150	116	150	91	152	82	76	86	93	78	78	79
												Three Hours' Run.										
49	280	700	3,500	127	10	8,030	23-40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
49	270	800	3,000	140	9.5	14,050	40-0	58	172	128	260	127	157	101	178	92	75	92	94	87	78	87
48	280	826	3,000	140	9.5	18,080	53-0	58	172	128	260	125	157	101	178	92	80	96	99	88	80	85
48	280	910	3,000	135	9	23,600	70-0	61	173	131	310	129	160	106	180	97	81	97	99	87	81	88
48	280	902	3,000	135	9	27,900	83-0	62	172	127	300	125	152	101	175	93	78	93	95	88	84	87
48	285	910	3,000	135	9	33,050	98-0	62	172	128	320	127	162	104	177	97	80	96	96	90	82	88
48	285	925	3,000	137	9	38,170	113-0	63	171	128	320	128	163	104	178	96	81	96	98	90	84	88
48	285	925	3,000	137	9	42,800	128-0	64	171	128	320	129	163	105	180	95	81	97	99	90	81	88
46	285	925	3,000	150	9	53,781	161-0	62	167	120	270	122	163	101	179	92	81	93	99	84	79	87
47	285	920	3,000	125	9	58,664	176-0	62	166	124	270	123	161	101	180	94	82	95	95	85	81	88
47	280	910	3,000	140	9	63,701	191-0	60	168	129	280	130	170	109	185	100	80	99	100	90	83	89
47	275	900	3,000	135	9	67,360	202-0	60	168	127	300	128	163	104	180	98	78	97	98	88	81	89
50	285	920	3,500	150	10	72,306	217-0	62	175	131	270	134	173	110	189	101	79	102	105	95	85	92
55	320	1,050	3,500	155	10	77,276	232-0	64	182	135	275	136	178	112	192	101	81	105	108	97	86	94
58	330	1,040	3,500	195	10	82,256	247-0	66	183	138	265	135	177	113	191	102	82	106	109	98	87	95

Capacity of Machine—30 Cub. Ft. of Air per Hour at 3,000 lb. per Sq. In.

	Average Revolutions per Minute	Circulating Water lb. per Min.	Injection Water lb. per Min.	Average Steam Pressure lb. per sq. in.	Average Exhaust Pressure lb. per sq. in.
Pump up	338	244	0.6	151	8
Three hours' run	331	248	0.56	146	9

two connecting rods, etc. The card from the fourth stage would seem to indicate a large cylinder clearance, but it may be pointed out that sometimes the indicator itself adds quite a large percentage clearance to a small high-pressure cylinder—especially when connections are long, due to the necessity of passing through a water jacket. Regaring the intercooling effect as shown by the curves, it might be thought that improvement could be effected. In practice, however, a long continuous run at full pressure is very seldom required of compressors of the charging type—therefore the intercoolers need not be of such dimensions as those required for a continuous duty machine. Again, the question of economy is of less importance.

With the increasing number of applications of high-pressure air, and especially with the growth of the Diesel engine industry, more attention is being paid to the design of high-pressure machines, and in view of the scarcity of trustworthy literature on the subject, the foregoing brief outline of some of the points which arise may serve a useful purpose.

stated last year that if Germany had not been so well equipped for the manufacture of aniline dyes the Allies would have won the war long ago.

One of the most powerful high explosives we have in use to-day is an aniline dye. Picric acid, which is a beautiful yellow crystalline body, has been used for many years for dyeing clear shades of yellow on silks and woollens, and through an accidental explosion occurring in a dye works where picric acid was stocked it was investigated as to its use as an explosive. The result of this was that the French, who were the first to use this high-shattering explosive, simply ran the fused acid into shells, thus forming their famous explosive, melinite, while in Britain the same substance goes under the name of lyddite.

Nearly all the other explosives, if not highly colored bodies, like picric acid, are closely related to dye-stuffs and their intermediate compounds, and are made mostly in the same plants as the dye-stuffs themselves.

An explosive is a substance which, when its physical surroundings are suddenly changed, as by heat, or a sudden

High explosives or "shattering" explosives are used, as their name indicates, to do as much damage as possible. Picric acid, and more especially when mixed with other substances like lead salts, forms an exceedingly explosive substance when suddenly heated or exploded by a detonator.

Another high explosive in great use at present is the famous T.N.T. Who would associate tri-nitro-toluol, this most widely used high explosive, with gasoline? Yet this motor petrol, called toluol, which is a liquid resembling water in appearance, and greatly used by dry cleaners to clean suits and dresses, is the parent substance of T.N.T.

RECENT activities of the Society for the Promotion of Engineering Education included the publication of an article on "Technical Book Writing," by J. A. L. Waddell, consulting engineer, Kansas City, Mo., which points out some of the major details to be considered by the authors of scientific articles. The discussion covers the mechanics of technical writing and indicates the procedure of preparing data for writing.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

THE MODERN USES OF RUBBER

By D. Street

A STOCK phrase is that "there is nothing like leather" but at the present day this should be changed into "there is nothing like india-rubber," as never at any time has its use been so varied and its commercial demand so great. One sure sign of an article's utility is the number of substitutes placed upon the market, and of substitutes for rubber there have been scores, not one of which possessed all the qualities of the genuine article, and although very many nearly approached it yet they were short of one essential feature. Rubber is a curious substance, much more so when manufactured than in the raw state, the quality which so far renders it unique being its high degree of elasticity, which it shows to the best advantage in the rubber threads used for those textiles, known as elastic. Motor tires, waterproof fabrics, hose piping, tobacco puches, surgical tissues are all dependent on that elastic quality of the rubber, which causes it to spring back to its original state, whilst a host of other articles, no less useful, are made from the hard form of it commonly termed vulcanite. Owing to the many uses to which rubber is now put, there is a considerable demand for old rubber materials, such as worn-out motor tires, door mats, tubing, etc., all of which are utilised again into something after the style of working up shoddy, etc., into fresh material.

Origin and Composition

Existing as a natural gum in the stem or trunk of a large number of tropical plants, rubber in the natural state forms a thick milky fluid which oozes out from cuts made in the bark of the growing tree, and is collected in small tin cups which are cemented to the trunk with clay. On emerging the juice is whitish, but darkens and coagulates with time and exposure into a dingy brown mass. The shape in which it is imported varies largely according to the collector, some being in the form of round balls, known as nigger heads, and others in blocks, thimbles, cakes and bottle-shaped masses. Chemically, rubber or caoutchouc is a complex hydrocarbon and consists of several different gums, or bodies which have varying degrees of solubility. Water, of course, has no action upon raw rubber, but it dissolves in a mixture of carbon bisulphide, benzol and naphtha. No single solvent will dissolve it entirely, some of its constituents being acted upon quicker than others by the various solvents used, and the raw substance seems to consist of a highly porous network of cells having different sums in their interstices. At a temperature of ten degrees Centigrade raw rubber is a solid body with very little elasticity, while at 36 degrees it is soft and elastic to a high point, and is capable of being stretched to sixteen times its length. Further increase of temperature lessens these elastic qualities and at 120 degrees Centigrade it melts. In the raw state rubber has several peculiar properties one of which is that after stretching and cooling suddenly in the stretched condition it retains its new form, and only regains its former shape on being warmed. Another striking feature is its strong adhesive capacity; that is so powerful that the raw substance cannot be cut with a knife unless the blade is wet, and freshly cut portions if pressed together form a homogeneous mass.

Early Applications

The first use of rubber gum was for waterproofing fabrics and in 1823 a solvent was found by Charles Mackintosh which allowed a thin coating to be applied like paint. Owing, however, to its sticky nature, it made very little headway for waterproofing purposes, until in 1839 an American, named Goodyear, found that a mixture of rubber and sulphur heated together produced a body very different from the raw gum—being elastic at low temperatures and free from stickiness right up to its melting point. This discovery, known now as vucanizing, opened up an important future for rubber, and by varying the amount of sulphur together with the heat and duration of the process, products are obtained which range from the softest flexible tubing up to the material used for making the barrels of fountain pens and the mouth pieces of pipes. On broad lines the outline of the vulcanising process is as follows:—The raw material is well masticated between hot rollers and is incorporated with the necessary amount of sulphur, it is then pressed into moulds which clamp together and prevent any loss of shape by the rubber contracting. Heat is now applied, and, when the process is over, the rubber will be found to have taken the shape of the mould permanently, being now much more elastic than the raw gum and perfectly insoluble in all solvents.

Rubber possesses great adaptability for mixing with other bodies—which manufacturers are perfectly aware of, and articles solely of the pure vulcanised gum are only made for special purposes. Among the many substances which lend themselves to combination with rubber are, zinc sulphide, white lead, asbestos, barytes, litharge, chalk, hemp and boiled linseed oil. By means of judicious admixtures of these rubber can be brought to any degree of hardness, and the cost can be manipulated to the makers', if not the users's satisfaction. Low-prices rubber articles which are required to have the life and elasticity of good rubber cannot be recommended for the very good reason that good material is expensive and all makers must have a profit.

Non Reclaimable

A popular but utterly erroneous impression is that old articles of rubber, like old brass and copper can be "melted again." The only possible way of melting rubber is to heat it, and this entails absolute destruction, leaving only a sticky evil-smelling oil behind it, which never again sets into the old solid form. Of course, second hand rubber is put to many purposes, but this can only be done by rasping it into fine particles and cementing these together into a solid form with either boiled linseed oil or a little new rubber solution. Once vulcanised, rubber is proof against all known solvents; many will soften it and cause it to swell up in size but none will bring it back to a workable form, and although thousands of attempts have been made to bring it back into the same condition as before the heating with sulphur took place, they have all failed.

Buyers of rubber articles will have noticed a big difference in the durability between low-priced,—not cheap,—goods and the standard makes, which is easily accounted for by the following facts. An unscrupulous manufacturer will buy up old used scrap, for example only, at 5c per pound, grind it up and mix it intimately with oxidised linseed oil, or make a better quality by substituting a small portion of new material for the oil. This gives him a material which he is able to put on the market much below the price of the genuine stuff, leaving him in addition a very handsome profit. Provided the shoddy rubber and the binding material are both of the same quality of rubber, chemical analysis will not detect the sophistication; the only test is by actual wear in which the difference is very speedily found. The reason why remanufactured rubber will not stand hard wear is the lack of coherence between the particles of old material, these being only held together by the merest film of new rubber, so that instead of a tough homogeneous substance which new rubber consists of, the particles readily crumble and break away. When such a binding substance as linseed oil is used, the strength is much less than rubber solution, and owing to this oil setting into a flexible substance very like rubber in appear-

ance, it is a favorite constituent of rubber compositions.

For such purposes as door mats, cheap shoes, rubber heels, toys, etc., the use of the resuscitated material is legitimate; but when applied to such purposes as rings for the packing of high pressure steam pipes, it cannot be so looked upon, since in this case it constitutes a serious danger. Hard vulcanised rubber was formerly much used for insulating purposes in electrical trades, and for such purposes many of the compositions made from old or reclaimed rubber are quite effective enough, provided they do not deteriorate with time and lose their insulating property. At the present day, however, rubber for electrical purposes has been largely replaced by paper, cotton, mica glass, etc., so that its importance to this industry has grown very much less.

Causes of Decay

Like water, rubber is "incompressible," that is to say its form is readily modified by pressing or pulling, but the actual bulk remains the same, and if compressed in one direction it expands equally in another. Oil or grease of any kind is a deadly enemy to rubber, which softens under its action and quickly loses its elasticity and strength. Sunlight is also destructive to it, and sets up a gradual decomposition which nothing can prevent; in fact rubber articles of every kind seem to undergo a slow change in their composition, becoming more brittle with age, and with mackintoshes the protective layers become friable and fall away. Immersion under water is the best preservative for rubber, and as most people are aware one day's exposure to sunlight works more mischief with a rubber-proofed garment than three months' wear in wet weather. What the chemical combination between sulphur and raw rubber is, no one as yet knows; but once vulcanised the sulphur is held tenaciously so that it cannot be eliminated by any of the agents so far available, and the reactions between the two seem to be deep seated and difficult to follow.

A fortune awaits the man lucky enough to invent a method of reclaiming old rubber or to find a substitute having all the properties of natural caoutchouc. This field of research has engaged the intellects of many distinguished chemists in the past and is still doing so to-day. Some time ago a patent for obtaining a rubberlike body from cereals was brought out; this was based upon the chewing of corn into a sticky gum which many of us are familiar with as children, and the process was very similar to that of mastication—namely washing away all the starchy granules until nothing was left but a grey glutinous substance. This, like many other ideas, does not appear to have met with success, as nothing further has been heard about it. Substitutes for rubber have been exemplified for years in the case of the composition used for printers' rollers; this used to be a mixture of glue and treacle which set into an elastic rubber-like substance; to-day the treacle has been replaced by glycerine but the properties are much the same. Rubber, one way or another, accompanies man throughout his earthly pilgrimage. As an infiant his soother is composed of it, later on, if successful, the tires of his motor are shod with it, and by means of a vulcanite pen he signs his cheques and other papers with it, while after nature has failed him the foundation of his latest teeth is ubiquitous rubber.

SEWAGE PURIFICATION BY ELECTRICITY

By C. T.

THE uses of electrical energy are so vast that it is little wonder that attention is now being paid to its employment for sewage purification. A process has recently been invented by which crude sewage is passed through a trough, partially fitted with electrodes placed at right angles to the line of flow and connected in parallel with a current of low voltage. The system is based on the theory that sewage containing table salt and other electro is rapidly decomposed by the passage of the current and that caustic soda, nascent chlorine, hydrogen and oxygen are thus evolved. Part of the freed chloride combines with the soda, lime and iron thrown off by the electrodes, and hypochlorites are thus formed, which attack and break up the organic matter. Experimental plants on this system have been provided in several small communities with varying success. Another method has been tried in the borough of Queen, New York, and at the stockyards in Chicago. This system differs from the former by the provision of a paddle between each electrode, the rapid motion thus engendered keeping the sewage constantly agitated and the face of the electrode well secured. To obtain the requisite standard of purification, quantities of lime are added, and engineers are by no means in perfect agreement as to whether it is the lime or the electrolysis which performs the more efficient work of purification. The cost of working this system is unattractive, but it is interesting to learn that steps are being taken to harness electricity for the purpose of sewage disposal, as the subject is one of increasing importance and has not yet been perfectly solved.

PATTERNMAKING NOTES

By J. W. Broadbent.

DURING a wide experience of pattern making, the writer has had numerous opportunities for observing the varied success attending the use of nearly every kind of wood used in the construction of patterns. Perhaps it has been the amateur, who, making his own simple pattern out of a packing case, has sent it to the foundry, and, outside a few strong words by the moulder has had produced for a few cents what would have cost as many dollars if placed in the hands of a competent pattern-maker supplied with the best of materials.

Wood Not Perfect

Until some material is produced which

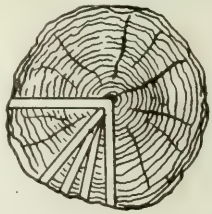


FIG. 1.

is less sensitive to atmospheric changes than wood, we must still use this material for patterns, and it is only by the skill and judgment of the pattern-makers that the tendency to warp and twist can be overcome.

For general use, white pine is the wood which alone has stood the practical test and granted that good sound boards are obtainable, no better material could be desired.

It is soft, easy to work with, cutting tools, and comparatively free from liability to warp, and then again it is

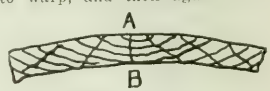


FIG. 2.

cheaper than the majority of woods. Boards under 12 or 14 inches in width should be discarded for pattern work, as narrow boards are hard and heavy, and more difficult to work, wherever wide boards are from trees of mature growth and farther away from the outside sap.

One of the first things to consider is that the wood must be perfectly dry and thoroughly seasoned, and the natural process of air drying is recommended in preference to kiln dried stock, provided that the wood is sheltered from the weather and that the air has free access to all parts of the plank. It naturally follows that in kiln dried wood the outside surfaces and ends of the board are dried more rapidly than the inside, producing a state that when the pattern is being worked and fresh surfaces are brought into contact with the atmos-

FIG. 3.

phere, the wood—released from the stresses of the outside surfaces—warps.

Cause of Warping

All timber is porous and in the living tree these pores which run lengthwise of the log, are filled with liquid; it is the evaporation of this liquid which sea-

sons or [illegible], consequently the ends of a board always dry first, which causes the ends to crack or check. For small and delicate patterns, a close grained wood, such as mahogany, should be used, for in a close grained wood the pores are smaller and moisture cannot enter so freely as in an open grained wood, and therefore is not so susceptible to the changes of temperature and humidity.

Mahogany is an excellent wood to use for patterns provided a good quality is obtainable, it is easy to work, is hard and strong, and takes glue and varnish nicely.

FIG. 4.

Most people, including many pattern-makers, seem to connect quarter sawed lumber with hard woods, and look on it only as a means of showing the beautiful markings on the face of the board. This is not so, for we may get quarter sawed pine, which may be used to advantage in many patterns where there are no ribs or supporting pieces to hold the pattern straight.

Quarter Sawed Lumber

A quarter sawed board is cut from the log radially as in Fig. 1, and can be easily distinguished by looking at the grain on the end of the board.

There is considerable waste in cutting quarter sawed stock, which naturally makes the lumber more expensive, as only a few boards are sawed radially from each log, but when we consider the convenience of having a pattern keep its shape and stay practically straight during many changes of temperature or humidity, it is surely worth the little extra expense.

Under the best of conditions, a board will have a tendency to warp, as in Fig. 2, and unless one side is damp, the board will always curl away from the part nearest the heart of the tree, the reason being the side A is of older growth, and the cells are more compact than the side B, which is nearer the sap wood. As the wood seasons, it naturally follows that the newer growth with the more open cells, will dry and shrink faster than the side A, thus causing the board to warp in the manner shown.

Gluing Boards

When gluing two or more boards together they should be gluel as shown in Fig. 3, by placing two outsides or two insides together so that the tendency of one piece to warp will counteract that of the other.

Gluing boards together with the grain of one board at right angles to the other always proves unsatisfactory and should never be attempted with less than four pieces, for if the joints do not split altogether, the shrinking of the boards in opposite directions warps the whole in such a manner as to be practically useless for a pattern which is required to keep its original shape.

Fig. 4 shows a method often used where a fairly large flat surface is needed in a pattern where there are no ribs or other means of helping to keep the wood straight. A wide board is cut into narrow pieces and the pieces reversed and glued togteher as shown, the warping of the narrow pieces in opposite directions is so insignificant as to have very little effect on the shope of the whole.

USE AND ABUSE OF TAPS

By L. E.

IT IS by no means uncommon for a careful machinist to use small taps, such as ⅛ in., 3/16 in., ¼ in., 5/16 in. and ⅜ in. thread taps for months, and even years without a single casualty by breakage. It is much more common to witness a careless smashing up of such useful accessories by not only boys but by men who ought to know better. It is suggested that this proves that there is a way that right and a way that is wrong respecting the use of small hand taps. Many workers break taps as a result of sheer crelessness and culpable neglet of care of the employer's goods, instead of being as careful of the employers good as their own.

There are however many cases of taps being broken as a result of sheer ignorance of the manner in which such should be used. For this class of individual a few hints may not be out of place. In respect of most sizes of taps there are three to a set. With special types there are sometimes only two to a set, and the reason for this is perhaps that some of them are, size for size, stronger as a result of the comparatively larger core. The set of three is more preferable for use, for economy lies that way, whilst it is believed that the saving of one tap in a set ensures early disaster, especially in the hands of the careless. With the sets of three, which are called by various names by different operators in the mechanical trades, such as 1st, 2nd and 3rd, taper, second and plug and taper, intermediate and bottoming; it will be found that the taper tap of a set is reduced down from full diameter to just under the core diameter in about 50 per cent. of its length. The second tap is tapered up just a thread or two, whilst the third tap for bottoming purposes, is full diameter for the whole of its length.

Now, to tap a hole in a piece of mild steel, say ⅛ in. or 3/16 in. thick, even by a novice, is a comparatively easy job but to tap a hole with similar taps in a piece of similar material 2 in. thick, or a hole 2 in. deep in a piece of say, 2½ in. thick, is quite a different matter, as may be easily proved. If one tries to "push" the first tap through the whole of the 2 in. or 2 in. deep in the 2½ in. material, both the operator and the tap will experience trouble. The experienced man will first use the taper tap, and carefully send it as far as he can with force guided by expert judgment. When he finds it goes too hard, and that the pressure he is applying will probably smash up the tap, he turns it back a turn, and goes on again, going ahead and coming back, until he has got the first tap in as far as, in his judgment, it is safe to go. He then withdraws that tap and introduces the second tap, and this he "plays" in a precisely similar manner as with the first or taper tap. Next he uses the third tap, and obviously if the second tap has gone through all right, the third or sizing tap, will surely follow.

Purchasers of taps will be well advised if, when inspecting a delivery of taps, especially of the lower varieties, they reject all plug taps that have countersunk or drilled centres at the entrance ends. Such taps break like a carrot as soon as the operation of "bottoming" is attempted.

PATTERN FOR LARGE MAIN CIRCULATING INLET VALVE

By James Edgar

IN view of the fact that shipbuilding and marine engineering have recently come to the front as important Canadian industries, the article which follows, taken from the columns of our contemporary, the *Foundry Trade Journal*, will doubtless have more or less interest for those of our readers who are directly or indirectly concerned with the production of patterns and casting for marine engines and their accessory equipment.

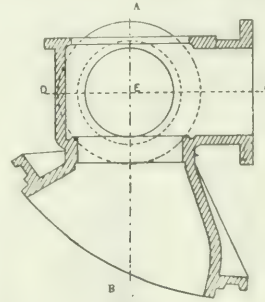


FIG. 1.

The first thing to be decided when making a circulating inlet valve of the type shown in Fig. 1 is whether the square chest shall be made in the form of

FIG. 2

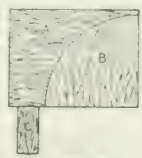


FIG. 3.

FIG. 4.

a shell pattern, leaving the moulder to cut a print in the sand and use the inside as a corebox, or whether a block pattern shall be used with a corebox. Both methods of construction have advant-

FIG. 5.

ages. The shell pattern is certainly more economical, as it takes much less timber, and the expense of making a corebox is saved. It is also much lighter, and this is a very distinct advantage if the pattern has to be tried to place in the ship.

On the other hand, a blocked-up pattern will stand much longer, and prove cheaper in the end, if many castings are wanted. However, it is very seldom that more than two or four castings of such a chest are wanted. It is usually necessary to "hand" this job, as there

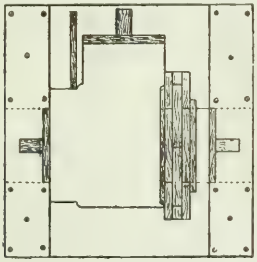


FIG. 7.

are almost certain to be cross angles on the flange of the square chest. This flange fits against the shell of the ship, and the position is usually marked on the drawing, the numbered frames being given. Occasionally approximate distances are given on the drawing, and after the pattern is made, it is checked at the ship, but more often moulds or templets are supplied by the mould lift from which the pattern is made, and sent off to the foundry. If the pattern-maker has to try it to place, a distance will be given from the line A B to a datum line, and, of course, the top flange must be level.

Two half-lapped frames should be first got out to make the joint of the pattern. They are dowelled together, and should be made of 1¼ in. or 1½ in. stock. It will be noticed in Fig. 6 that the frames

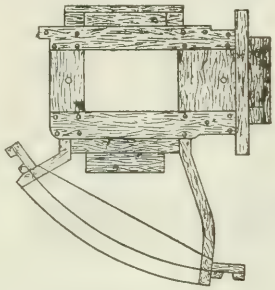


FIG. 6.

include the branch C. It makes a much stronger job to bring the frames to the face of the flange than to fit the branches quite separately. It is also well to make the main body D with grounds and staves carrying it out to the face of the cover flange. The cover flange, not being thick, can be screwed on top. A really strong job can be made of the staved-up body by fitting three stays about 3 in. broad by 1½ in. thick, and letting them into the grounds as shown in Fig. 2.

When the body has been fixed in position, the branch can be got out. It should be blocked up solid, and if a templet is stitched to it and a block screwed on the face to keep it square on the table, it can be cut at the bandsaw. The arrangement is illustrated in plan in Fig. 3, A being the templet, B the branch, and C the squaring block. The flange can be screwed on to the face. The prints for the branch C, Fig. 1, which would be 16 for the end of the chest, which will be still larger, had better be made with a 1 in. plate thicknessed with 2 in. timber on the back, as seen in Fig. 4. The top branch E, Fig. 1, unless it is very shallow, will be better built with segments. If it is very deep it can be staved, but staves have the disadvantage that they cannot be fitted and screwed as well as segments. The flange for this top branch must, of course, be dowelled on.

The square chest ought to be made and finished quite separately from the valve body and screwed on afterwards. It should be made to a line sufficiently far back from the face to clear the angles, the handling being done by alteration strips. Two plates have to be made for the top and bottom, and they can be temporarily battened together. Two ends can likewise be got out. The side pieces must be very carefully drawn off and dowelled together on edge. To build this chest one of the end squares should be first screwed to the bottom plate and two sides screwed on. The top end piece can now be laid on top of the other, the two temporary battens screwed on the outside. The dowelled sides can now be put in position, and temporary battens likewise screwed on to them. The top plate can next be put on.

The method of building one half on top of the other has obvious advantages. If care has been exercised in squaring and dowelling the sides, the top should lift "sweetly" from the bottom and without any drag. When the corners of the chest have been rounded off, the battens can be removed, and each half screwed to the valve body. A print will have to be screwed inside this chest to carry the body core. It will be observed that the print is smaller than the core for the valve seat, to allow sand around it.

The flange and the fitting strips on the face can now be attended to. Pieces ought to be screwed on, carrying the body to the face of the flange. It is usually possible to change the chest from port to starboard, by bringing the top piece to the bottom and the bottom piece to the top. The side pieces can also be turned upside down. The flange will have to be screwed on, taking care that the flange on the moulder's bottom half is screwed from the inside of the chest and on the top half from the outside. It is not necessary to explain the making of the fitting strips and spigot, which are screwed on the face. The moulder, of course, will have to loosen off these strips and also the supporting ribs on the sides. A view of the face is shown in Fig. 5. The joint of the finished pattern is shown in Fig. 6.

In a valve as large as this, a plate or an open frame would be quite satisfactory for the body core. Some foundries prefer a plate, others prefer a frame. From the pattern-maker's point of view the work is the same, except that if a plate is made the end grounds for strickling the core will be a half diameter, whereas if a frame is used they will be a half diameter less the thickness of the frame. A plan of the frame with the grounds on is shown in Fig. 7.

A bridge piece should be made to carry the valve seat. It can be built in two or three thicknesses, and should be about 3 in. broad. A runner is screwed on each face of this ring, and the strickles will work on this runner with a semi-circular strickle, guided by a strip on the frame.

There is still a top branch core to be made. It is 16 ins. in diameter, and might be made with a pin board, as shown in Fig. 8. It may be that the moulder will prefer a box, and one can be made almost as cheaply as the pin board. An end view of a suitable box is shown in Fig. 9 and a plan in Fig. 10. It is simply a square frame with mitred skeleton pieces nailed inside. A skeleton box made in halves would be almost as expensive as a solid box, and this style is as convenient for the moulder, as it can be taken apart like any ordinary frame corebox.

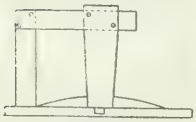


FIG. 8

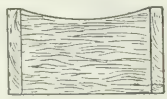


FIG. 9.

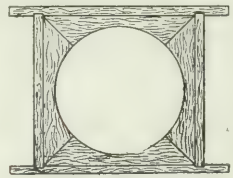


FIG. 10.

Development of Ocean Service Shipbuilding in Canada--VII.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

SHIPBUILDING on Canada's Great Lakes and on the St. Lawrence is particularly active at the present time in view of the approach of the close of navigation for another season, and the necessity there is that as many completed ships as possible reach the sea before our waterways become ice-bound. That the Port Arthur Shipbuilding Co. is making good headway in their deliveries is evidenced by the fact that the Ugelstad, launched on June 23, is now in the service of her owners, and the War Fish, launched on August 4, is scheduled to follow suit this month. Both vessels were originally ordered by Jas. Playfair, of Midland, Ont., but during construction other interests purchased them. Constructional, equipment, and machinery installation features are as follows:—

Features and Dimensions

The hull has the following principal dimensions:—Length over all, 261 ft.; length between perpendiculars, 251 ft.; breadth moulded, 43½ ft.; depth moulded, 28 ft. 2 in. It is of the single deck type, with poop bridge and forecastle, steel deck house on bridge, and deck and chart room on top of deck houses, with navigating bridge. The hull is built on the transverse system, with the propelling machinery amidships, and the coal bunkers in wings. There are two cargo holds, with two hatches to each, one hold extending from the collision bulkhead to the boiler room bulkhead, and the other from the engine room bulkhead to the after-peak bulkhead. A water bottom, 2 ft. 9 in. deep, extends from the collision bulkhead to the after-peak bulkhead. The construction is for the highest class of Lloyd's ocean service, and in accordance with the British Board of Trade requirements. The size of the machinery space has been arranged to approximate 13 per cent. of the gross tonnage, thus attaining a reduction of 32 per cent. from capacity tonnage.

The hull is built with flat plate keel and bilge keels, the latter, extending for about 100 ft. amidships, being of plate 9 in. deep, connected to the shell with angle bars fitted on short lengths, extending from butt to button shell, the plate being continuous. Each vessel has a straight stem and elliptic stern. Channel frames are fitted and extend from tank margin to main deck, and alternately to bridge deck, without hold stringers or 'tween deck beams. Plate floors are fitted on every third frame, except in engine and boiler space and forward of three-fifths length, which are 24 in. centres. The propeller frame is according to Lloyd's requirements, with rudder post extending to main deck, to which it is attached by angles and deep transom plates. The rudder is of the single plate type, with arms alternately on the port and starboard side. The hull is divided by four watertight bulkheads, and a watertight sliding door is fitted in the engine room bulkhead, to give access to the tunnel. There is a screen bulkhead between the boiler and engine rooms, with door and portable plate for drawing the condenser tubes.

The engine foundation is built up of plate and angles, with girders underneath, to line up with the fore and aft girders on the water bottom. The boiler foundations are of longitudinal plate girders, with large double angles on top edge and connected to tank top with double angles at bottom. The deck house on the bridge is of steel, 7 ft. high, of plating, 12.2, stiffened with 3x3x6.1 angles, as are also the engine and boiler castings. The flying bridge is built from the roof of the chart house to the ship's sides, and is 4 ft. wide, carried on angle iron framing supported on angle iron stanchions.

Auxiliary Equipment

A steam windlass 8 x 8 in., is fitted with hand attachment and friction brakes. The steam steering engine, 6 x 6 in., is placed in the after end of the engine casings, with the horizonal shaft protruding through the after side, with the bracket and chain drum on deck. Two 22 ft. lifeboats, and one 18 ft. working boat, are provided, together with life belts and life buoys as required by law. The bridge deck provides the captain's, first and second officers' quarters, which, with the accommodation for the crew, are complete with every modern convenience. The electrical installation includes one 7½ k.w. generator, with equipment for lighting the whole vessel, the sidelights being fitted for electric light as well as for oil.

Engine Data

The propelling machinery, also built by the Port Arthur Shipbuilding Co. consists of engines of the single screw, 3 cylinder, 3 crank type, with cylinders 20, 33½ and 55 in. diam. by 40 in. stroke, developing about 1,400 i.h.p. at 80 r.p.m. Steam is supplied by two boilers, each 14 ft. diam. by 12 ft. long, built for natural draught, at 185 lb. pressure. The boilers are equipped with corrugated furnaces, 42 in. inside diam., with separate combustion chamber for each furnace.

S.S. UGELSTAD ON THE WAYS READY FOR LAUNCHING

OUR LATEST CRAFT—THE AUXILIARY SCHOONER

By Capt. Geo. S. Laing.

THE seas and oceans are now graced with a strange craft called the auxiliary schooner. Our Canadian and American shipyards are turning them out in considerable numbers. These vessels could be well termed half-breeds, in the sense that they have both the steamer and the windjammer embodied in their architecture. It is certainly something to be thankful for in these war days with its shortage of iron and steel products and dearth of ships to see this wooden vessel with her forest grown hull, and her internal combustion engines come among us.

For over a decade now we have been accustomed sighting the auxiliary schooner in the shape of fishing craft and a few coasters, but this article is concerned only with the up-to-date foreign trading auxiliary schooner which sets out for any part of the world, and has a carrying capacity similar to the great bulk of small steam tramps.

As one who has been employed both in sailing ships and steamers, the writer will attempt to show that the auxiliary schooner possesses many attractions and should have a bright future ahead of her.

Handiness in Port

In many harbors it is customary to make two or three shifts from one dock to another in the loading or discharging of a cargo. In the old style sailing ship this meant towage. In the ordinary tramp steamer it either means towage or getting up steam at a time when the steam engineer wants to see the inside of his boilers. With the auxiliary schooner, especially of the twin-screw type, this shifting around in port would be no trouble whatever. It only takes minutes in the motor engine room to start up, where it takes hours in a steam propelled ship.

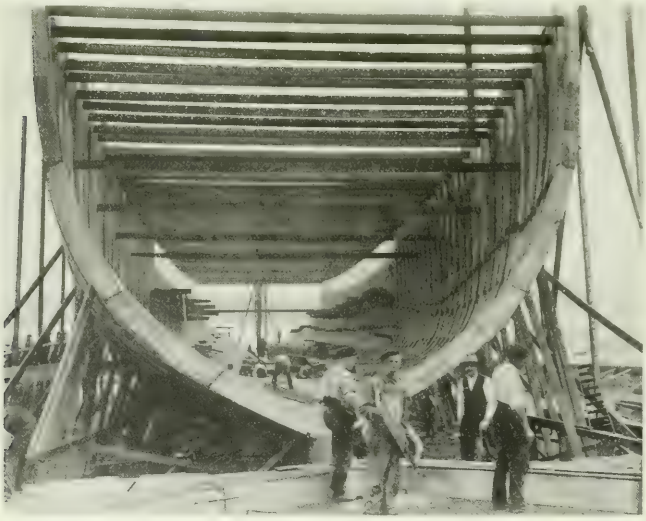
Dry Dock Troubles

With the ordinary tramp steamer or steel sailing-ship, the matter of a foul bottom is ever present and in both these craft a visit to the graving dock every year is essential. The reduction in speed caused by barnacles and grass growing on iron or steel vessels, runs as high as 40 per cent. after a year's absence from a dry dock. This is appalling, but it is true of all tropical traders, for it is in tropical or sub-tropical waters that the most of animal and vegetable life attaches itself to a ship's bottom—there to mature and flourish.

The auxiliary schooner protected with yellow metal may run afloat for two or three years without going into dry dock as far as a foul bottom is concerned. Dry dock dues are among the heaviest of the ship owners outlays.

On Ocean Routes

The auxiliary schooner has great advantage over the ordinary steamer by way of drawing power from the heavens, utilizing her white wings in favorable trade winds, monsoons, or the prevalent westerlies in the high latitudes of both hemispheres. During such times, the engineer will be able to throttle her a little and still make 10 to 12 miles an hour. Take for instance the run from Cape of Good Hope to Australia or New Zealand, and again from the Antipodes to Chili and Peru. On these routes the chances are that in many cases a vessel is simply chased with fair wind and following sea, if a proper course is taken according to the season.



WOOD SHIP CONSTRUCTION IN BRITISH COLUMBIA.

In Very Heavy Weather

The most helpless craft afloat in very heavy weather is the low-powered steam tramp. A few will shoulder the sea,

AUXILIARY POWER SCHOONER "MABEL BROWN." FIRST OF ITS TYPE BUILT IN CANADA.

but the majority of them flounder around in a radius of six or eight points and frequently do big damage while in this intoxicated state. The reasons for this bad behaviour are due mainly to lack of steam power to hold steerage way in the sea, the lack of canvas to aid the helm, in keeping their heads in one position, and the heavy rolling and diving motions that greatly reduce the work of a propeller, by keeping it too often in the air and too little in the water.

An auxiliary schooner with her two-fold means of propulsion should be able to "heave to" and stay there with as much grace as a Grimsby smack or an Aberdeen trawler—two classes of craft that contribute to expert seamanship qualifications. A power schooner that is forced to "heave to," or "head reach" should be comfortable and reasonably quiet with a leg o'mutton spanker aft and a storm tri-sail forward, either on the inner bowsprit or foremast. Then with the starboard engine at half-speed for the port tack or the port engine at half-speed for the starboard tack, her movements should be that of a stately craft. Where this method works, one engine is stopped.

Her head should keep pretty steady at about 4½ points from the wind, thus taking the heavy sea on the bluff of the bow and at the same time making enough leeway to bring into play the valuable turbulent eddies from under her keel that help so much in staying the poundage waves on vessels "hove to."

To those who have not studied the wonderful effect of a ships "dead water"

eddies [illegible] a ship's track in a moderate breeze and you will notice that a comparatively smooth streak holds out against the surrounding waves for quite a distance. The same thing happens when a vessel drifts bodily to leeward, leaving thus a broadside wake up to windward. The use of heavy oils on high seas is another eye-opener. This again is beautifully demonstrated by watching the calm streak that the engine-room bilge water discharge causes through its oily nature.

Towage Elimination

Coastal or river towage, which was so damaging to sailing ship earnings, disappears altogether with the auxiliary schooner. There is little doubt that she will also create a new class of seamen and officers. Again, as owners and builders have given more attention to the comforts of the A. B's. and apprentices than has previously been done, the manning of these vessels will proportionately become easier, for you can still invite decent folks to sea if you treat them right in matters of food and quarters, two main items that the old windjammer and a considerable number of steam tramps never knew the meaning of.

As regards the apprentice system which is one of the finest points about the schooners, these youngsters will soon spread the sea fever amongst the boys of their acquaintance, and so the ball will begin to roll for a growing fleet of Canadian manned merchant ships—the foremost national asset of any country lucky enough to have a seaboard.

Compass Installation

From a navigational point of view, the [illegible] vessels [illegible] compass is undoubtedly the best for steering purposes but a dry card is the most efficient instrument for a standard or navigating compass. Here too, is a chance for our old friend the pole compass coming back to life on these wooden lowermast schooners. The wily deviation that haunts the compasses of iron and steel ships should be very much modified on our forest product which claims no magnetic attraction either in hull or superstructure. Of course to be absolutely non-magnetic, these vessels would require to be made entirely of wood with brass or copper fastenings. Small compass errors mean less risk of making fatal mistakes in course plotting and cross bearing work on the chart, especially in reef-strewn waters or foggy weather near a coast.

Regarding Breakdowns

The auxiliary schooner has one of her finest qualities ever ready, that of changing her status from a power craft, to a sailing ship or vice versa, and it would indeed be a most un-usual disaster that could deprive her of both her engines and sails. There is a point however that could be more assured in this connection. The sail area on the vessels having "bald" or "stump" lower masts might be enlarged to enhance the speed where fuel shortage or more unfortunate happenings came along.

The writer's suggestion is to fit these craft with lower-mast caps and trestle-trees which could be called on to support jury top-masts in time of dire necessity. [illegible] four, or five gaff top-sails which would often mean fifty miles a day on her speed.

Take a five masted with a fore, [illegible] the above plan was only adopted on the [illegible] With [illegible] would be the most popular plan of "housing" the jury masts that would play a part in the augmentation of sail area. On the other hand the schooner captains may be glad to carry spare masts on deck to lash alongside the two or three hatches that are in the waist of the vessel, and practically under water in gales. Spars lashed alongside of exposed hatches act as breakwaters and take the [illegible] of the waves that might otherwise stave in a midship hatch.

The Mabel Brown has a yard forward for use in "running," and although this class of foresail has to be lowered—owing to its peculiar gear—long before a square-rigger's foresail would be put in the gaskets, the sail is a very useful one where moderate winds are concerned. Again, this fore yard makes a nice boat boom in anchorages, and is also handy for guys and tackles that may be in use at that end of the ship.

INTERIOR OF HULL UNDER CONSTRUCTION, AUXILIARY POWER SCHOONER "MARGARET HANEY."

Choice of Rig

As regards the choice of fore and aft rig for these interesting vessels, it might have been worth a trial to rig a few out as barquentines, with double topgallant sails the highest canvas on the foremast. The other masts would then stand larger spacing, a three masted barquentine taking the place of a four masted schooner. Even with less engine power the barquentine might prove the better vessel for long voyages.

Rigs and Nations

The Russians and Americans have always taken to the all fore and aft rig in canvas, whilst the Norwegians, Italians and Nova Scotians have favored the three masted barque. There was a saying in sailor circles that no matter what foreign port one entered, there was sure to be found one or all of the following four things:—A British tramp steamer, a Norwegian barque, Swedish matches, and German musical instruments.

Good luck to the Canadian auxiliary schooner, may she break into the same category of popularity and usefulness. Her earning power and record for time on passages must not be too severely criticized at first, for the craft are in their experimental stage, and the men who engineer and sail and navigate them cannot be experts at the dual game

AUXILIARY POWER SCHOONER "MARGARET HANEY" READY FOR SEA.

in an instant. The captains of these schooners will act very differently on their initial long distance trips in accordance with the experience they have had on other vessels.

Take a windjammer man for instance. If the schooner is bowling along under the dual system and the wind is inclined to lift the weather leaches, it is probable that this captain will let his vessel off a point, whereas a cast iron steam raised captain will furl everything in the shape of canvas, even to the engine room wind-sail, and let her plug into the sea under screw power only.

In the end, who will make the smartest runs in these vessels, the man who has had to rely on wind only, or the man whose chart room is generally above a coal bunker? It is natural to assume that the master who has both sailing ship and tramp steamer experience will do the best. With the apprentice system a new breed of seamen and navigators will grow up with the auxiliary schooners.

Friction Elimination

The freeing clutch that allows the propellers to revolve when under sail only, is a grand device, as some trouble may be experienced in finding real helmsmen for these schooners—men who can steer anything and who understand the principles of steering. With the screws going round in their out-board motions, the vessel is more easily balanced with the rudder, and dead water under the counter causes less friction when the propelling screws are turning over.

It is to be hoped that in the official log of the new schooners such entries as this may be found under remarks:

"Strong wind with quarterly sea, all sails drawing. Hove hand log in several squalls and found vessel making fourteen miles an hour."

"Passed a tramp steamer, going the same way, in the second dogwatch. Vessel behaving well. Gripping to windward easily controlled by careful steering. Shipping very little dangerous water, hatches in the waist under special observation after dark."

PAPER FROM CANADA

A RECENT report indicates how rapid Canada's paper-making industry is expanding. Here are some rather interesting figures of her exports of paper:

1892	$91
1902	$24,780
1912	$3,881,063
1913	$6,327,774
1914	$12,686,896
1915	$15,509,582

But it is not much consolation to those of us who are experiencing a semi-famine of paper in this country to know that more than 80 per cent. of Canada's output goes to the United States. There is no doubt that Canada has in her hands an enormous industry in the provision of pulp and the making of paper.

COPPER IN INDIA

INDIA imported large quantities of copper from Germany before the war, although she has quite extensive copper deposits of her own. More or less rich deposits are said to exist in Southern India, Rajputana, Chota Nagpur and various places along the outer Himalayas. Various companies have exploited the copper ores of India during the last 50 years, but until quite recently the results have been anything but successful—due apparently to unscientific methods. The Indian Munitions Board has engaged experts in England to go out to India with the view to developing the industry on scientific lines.

Screenings

Three young fellows were strolling along a country lane, and saw approaching them a very patriarchal-looking old man. Thinking to take a rise out of him, they accosted him thus: "Hail, Father Abraham, Father Isaac or Father Jacob." "Nay, my sons," the old man replied, "I am none of these, but rather Saul seeking his father's asses, and lo! here have I found them."

An old hen was pecking at some stray carpet-tacks in the yard. "Now, what do you suppose that hen is eating those tacks for?" said Henry. "Perhaps," rejoined his little sister, "she's going to lay a carpet."

During the voyage of a great liner, a waggish Welshman was approached by a fellow-passenger, who said:

"We are getting up a tug-of-war between a team of married men and a team of single men; you are married, aren't you?"

"No," replied the Welshman, "I am only seasick; that is what makes me look like this."

For the first three years of their married life the wife's mother had lived with the young couple. Then, one morning, without even stopping to pack, hubby fled.

The young wife rushed upstairs and told the news to her mother. "I suppose some nasty low woman is responsible for his leaving you," said the latter.

"Yes, mother," said the sorrowing wife, "there was a woman in it."

"Her name?" demanded the good lady, palpitating like an enraged motor-omnibus.

"You, mother," came the whispered reply.

"Me? Well, I'm sure I never gave him any encouragement.

First Alderman—"Here's a fine looking street."

Second Ditto—"You're right; what's the best thing to do with it?"

"Let's have it dug up for a sewer."

"But wouldn't it be proper to have it paved first?"

"Of course; I thought you would understand that. Then, after it is paved and a drain put in, we'll have it repaved."

"All in readiness to be dug up again for the gas-pipe? I see you understand the principles of municipal economy. And after we have it repaved for the second time, then what?"

"Well, then it will be ready for widening. There's nothing I admire so much as system in the care and improvement of our roadways."

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FOUNDRY TRADE OUTLOOK ENCOURAGING

MORE than ordinary interest should be displayed by Canadian foundrymen in the coming conventions of the American Foundrymen's Association and American Institute of Metals, with their accompanying exhibition of foundry and machine shop equipment and supplies. The outbreak of war just over three years ago found the machinery business in its various spheres of activity in a somewhat sickly condition, and while a revival, probably unprecedented in its history followed and is still largely being maintained, it cannot be said that foundry work has cut a leading figure. It is of course true that machine tool castings were in large demand, and such products as cast steel shell billets were no insignificant requirement. Gray iron castings are the backbone of the foundry industry of any country, and while these were the constituent of machine tool equipment to an abnormal extent, the fact remains that the call for such castings as the constituent of a myriad miscellaneous line of products was materially restricted.

In recent months metal-working industries in both Canada and the United States have been passing through a series of readjustments, the extent of which is not perhaps meantime realized, and probably will not be for some considerable time yet, as the transition period is still far from being over. The advent of the United States into the war for one thing, and the slowing-down of shell-making in Canada for another, furnish the solution of the why and wherefore of the conditions as we find them to-day.

Shell-making, to meet both its own requirements and those of its Allies does not begin to tax America's steel-making and machining capacity as it has done in the case of this Dominion. There are other directions, however, where the excess capacities can find an outlet, and while gun-making can lay fair claim to a share of the latter, it goes without saying that the realms of shipbuilding and marine engineering are quite broad enough to include a multiplicity of enterprise in their construction programmes. Both [illegible] are essentials of the twin industries, that of marine engineering more than shipbuilding, and in spite of the fact that general mechanical engineering, stationary steam and railroad engineering require castings—gray iron and steel, of exceptional quality, size and weight, it may be said that each of the latter features enters into ship and marine engine construction to much greater degree, besides having the accompaniment of casting requirements, where quality, size and weight are not necessarily so important from a manufacturing standpoint.

Shell-making so far as Canada is concerned is being rapidly displaced by other, more substantial and permanent industries, and judging by conditions as we find them, little regret is being expressed; rather is there considerable satisfaction in evidence that so little dislocation of plant activity has been caused and in its train so little extended unemployment of operators. Shipbuilding and marine engineering may be said to have filled in Canada the gap that otherwise would have been left by the petering out of shell-making, and in so doing have awakened from their war overborne inactivity the manufacture of iron and steel castings to form the constituents of completed products hitherto much limited in quantity and commercial value.

Shipbuilding and marine engineering so far as Canada is concerned are but in their infancy, but we should not lose sight of the fact that the prospects and possibilities are such as to transcend those of shell-making, and with the achievement of the latter still fresh in our minds, is there any reason why we should not only equal its accomplishment but go one better. The past thirty months has been largely in the nature of a machine shop display, and while for the next handful of years at least, this departmental feature is likely to lose little by way of comparison, let us not forget that the foundry is going to have its innings and must needs measure up to its confrere.

The men charged with the administration of the Foundrymen's Convention and Exhibition to be held in Boston, Mass., during the week of September 24, realize that the field of effort is bigger this year than it has been since the outbreak of war, or for that matter at any time in the past, and that the atmosphere is clearer, so to speak, for real forward progress. It is not presuming too much to affirm that the accession of the United States to the Allied ranks has, in view of developments taking place and in progress there done for the foundry industry on this continent a service towards efficiency that a decade of peace-time or normal years would scarcely have begun to accomplish.

The production of marine engine and ship equipment castings is to a large extent new to foundrymen, both here and in the United States, under which circumstances there is all the more reason why the interchange of views made possible by such meetings and the Exhibition as are about to be held should be heartily welcomed. Canadian foundrymen have not participated as largely by personal representation in past years as they should, aside altogether from the period of the war. Now, however, being allied in a common cause, and filling, in addition, a common need, is there any good reason why aloofness should not be less marked on the coming occasion and for all time?

More than usually interesting business and social sessions and outings have been arranged by the Executive Council of the Associations, which taken in conjunction with the comprehensive display of foundry and machine shop equipment and supplies to be staged in the Mechanics' Hall, make it, from all angles, incumbent that every foundryman who can be spared from our shops, should make his headquarters in Boston for the week of September 24.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$46 95
Lake Superior, charcoal, Chicago	58 00
Standard low phos., Philadelphia	87 00
Bessemer, Pittsburgh	51 95
Basic, Valley furnace	48 00

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	60 00

FINISHED IRON AND STEEL.

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 25
Steel hoops	7 50
Refined iron	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Band steel, No. 10 gauge	5 75
Chequered floor plate, 3-16 in.	15 20
Chequered floor plate, ¼ in.	15 00
Staybolt iron	8 50
Bessemer rails, heavy, at mill	38 00
Steel bars, Pittsburgh	4 00
Tank plates, Pittsburgh	9 00
Structural shapes, Pittsburgh	4 00
Steel hoops, Pittsburgh	5 25

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	5 00
Structural shapes	5 00
Plates	8 00

FREIGHT RATES.

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	23.1	31 5
St. John, N.B.	35.1	45 5
Halifax	35.1	45 5
Toronto	18.9	22 1
Guelph	18.9	22 1
London	18.9	22 1
Windsor	18.9	22 1
Winnipeg	64.9	85 1

METALS.

	Montreal	Toronto
Lake copper	$33 00	$34 00
Electro copper	33 00	34 00
Castings, copper	32 00	33 00
Tin	61 50	64 00
Spelter	10 50	11 00
Lead	13 00	13 00
Antimony	20 00	20 00
Aluminum	67 00	64 00

Prices per 100 lbs.

PLATES.

	Montreal	Toronto
Plates, ¼ to ½	$12 00	$12 00
Heads	12 30	12 30
Tank plates, 3-16 in.	12 65	12 25

WROUGHT PIPE.

Effective July 5, 1917.

Size.	Black Standard Buttweld. Per 100 feet	Galvanized Standard Buttweld. Per 100 feet
⅛ in.	$ 5 00	$ 6 50
¼ and ⅜ in.	5 12	7 16
½ in.	6 46	8 03
¾ in.	8 17	10 29
1 in.	12 07	15 22
1¼ in.	16 33	20 59
1½ in.	19 53	24 61
2 in.	26 27	33 12
2½ in.	42 12	52 94
3 in.	55 08	69 23
3½ in.	69 92	86 94
4 in.	82 84	103 00

	Standard	Lapweld.	
2	in.	29 23	35 71
2½	in.	43 88	54 11
3	in.	57 38	70 76
3½	in.	71 76	89 70
4	in.	85 02	106 28
4½	in.	96 52	121 29
5	in.	112 50	141 34
6	in.	145 90	183 36
7	in.	190 40	238 00
8	L in.	200 00	250 00
8	in.	230 40	288 00
9	in.	276 00	345 00
10	L in.	256 00	320 00
10	in.	329 60	412 00

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES.

4" and under, 45%.

4½" and larger, 40%.

4" and under, running thread, 25%.

Standard couplings, 4" and under, 35%.

4½" and larger, 15%.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$20 00	$22 00
Copper, crucible	23 00	27 00
Copper, heavy	23 00	25 50
Copper wire	22 00	25 50
No. 1 machine composition	20 00	22 00
New brass cuttings	16 00	19 00
No. 1 brass turnings	14 00	16 00
Light brass	12 00	10 50
Medium brass	16 00	16 00
Heavy brass	16 00	18 00
Heavy melting steel	21 00	17 00
Steel turning	12 00	8 00
Shell turnings	12 00	12 00
Boiler plate	22 00	10 50
Axles, wrought iron	30 00	24 00
Rails	25 00	18 00
No. 1 machine cast iron	25 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	19 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	29 00	30 00
Mach. shop turn'gs.	8 50	8 50
Cast borings	12 00	8 50
Stove plate	19 00	19 00
Scrap zinc	6 50	9 50
Heavy lead	10 00	10 75
Tea lead	7 00	7 00
Aluminum	30 00	35 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Carriage bolts, ⅜" and less.	10
Carriage bolts 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers ..... List plus	10
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
Blank bolts	net
Bolt ends	net
Elevator bolts	50 and 5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	add 20
Machine screws, o. and fil. hd., brass	add 25
Nuts, square blank ..... add	$1 50
Nuts, square, tapped ..... add	1 75
Nuts, hex. blank ..... add	1 75
Nuts, hex. tapped ..... add	2 00
Copper rivets and burrs, list plus	30
Burrs only, list plus	50
Iron rivets and burrs	17½
Boiler rivets, base ¾-in and larger	$7 60
Structural rivets, as above	7 50
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R. bronze	25

MILLED PRODUCTS.

	Per cent.
Set screws	35
Sq. & Hex. Head Cap Screws	30
Rd. & Fil Head Cap Screws	10
Flat ⅞ But. Hd. Cap Screws plus	10
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. and semi-fin. nuts, over 1 in., up to 1½ in.	30
Fin. and semi-fin. nuts, over 1½ in., up to 2 in.	10
Studs	20
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws...list plus	20
Collar screws ....list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ..... add 40,	10
Cold pressed nuts to 1½ in.	add $4.50
Cold pressed nuts over 1½ in.	add $7.00

BILLETS.

	Per gross ton
Bessemer billets	$ 75 00
Open-hearth billets	95 00
O.H. sheet bars	80 00
Forging billets	100 00
Wire rods	90 00

F.o.b. Pittsburgh.

NAILS AND SPIKES.

Wire nails	5 50	5 45
Cut nails	5 70	5 80
Miscellaneous wire nails		60%
Spikes, ⅝ in. and larger	7 50	
Spikes, ¼ and 5-16 in.	8 00	

MISCELLANEOUS.

Solder, strictly	0 37
Solder, guaranteed	0 40
Babbitt metals	18 to 70
Soldering coppers, lb.	0 53
Lead wool, per lb.	0 16
Putty, 100-lb. drum	4 35
White lead, pure, cwt.	19 00
Red dry lead, 100 lb. kegs, per cwt.	15 45
Glue, English	0 38
Tarred slaters' paper, roll	0 95
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls., gal.	0 61
Linseed oil, raw, single, bbls.	1 49
Linseed oil, boiled, single bbls.	1 52
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A. ..list plus	20
Emery Cloth .....list plus	33 1-3
Borax, cyrstal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular	0 15
Wood alcohol, per gallon	2 15
Whiting, plain, per 100 lbs.	2 20

ROPE AND PACKINGS

Plumbers' oakum, per lb.	.09
Packing, square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila Rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.47

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 25%

CARBON DRILLS AND REAMERS.

	Per Cent.
S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	25
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	15
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	20
Drills and countersinks list plus	30
Bridge reamers	45
Centre reamers	10
Chucking reamers	10
Hand reamers	15

COLD ROLLED SHAFTING.

At mill ..... list plus 40%

At warehouse ..... list plus 50%

Discounts off new list. Warehouse price at Montreal and Toronto.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard bushings, 50%; headers, 60; flanged unions, 40; malleable bushings, 50; nipples, 55; malleable lipped unions, 50.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$11 00	$11 00
Sheets, black, No. 10, 11 50		11 50
Canada plates, dull, 52 sheets	11 00	11 00
Canada plates, all bright	12 50	12 50
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G	11 75	10 75
Fleur de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	12 70
Premier, 10¾ oz.	13 85	13 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN.

B

¼ in.	$12 00
5-16 in.	11 50
⅜ in.	11 15
7-16 in.	10 90
½ in.	10 70
9-16 in.	10 70
⅝ in.	10 50
¾ in.	10 40
@ in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	[illegible]
3-16 in.	[illegible]
¼ in.	[illegible]
5-16 in.	[illegible]
⅜ in.	[illegible]
7-16 in.	[illegible]
½ in.	[illegible]
⅝ in.	[illegible]
¾ in.	[illegible]

Prices per 100 lbs.

FILES AND RASPS.

	Per Cent
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	[illegible]
Black Diamond	[illegible]
Delta Files	[illegible]
Nicholson	[illegible]
P.H. and Imperial	[illegible]
Globe	[illegible]
Vulcan	50
Disston	[illegible]

COAL AND COKE.

Solvay Foundry Coke	[illegible]
Connelsville Foundry Coke	14 00
Steam Lump Coal	7 25
Best Slack	[illegible]

Net ton f.o.b. Toronto

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$33 00	....
1¼ in.	36 00	
1½ in.	38 00	[illegible]
1¾ in.	38 00	[illegible]
2 in.	45 00	33 00
2¼ in.	48 00	35 00
2½ in.	50 00	38 00
3 in.	58 00	45 00
3¼ in.	....	53 00
3½ in.	70 00	55 00
4 in.	82 00	67 00

Prices per 100 feet, Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	40
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	2 10
Union Thread cutting oil antiseptic	[illegible]
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

BELTING—NO. 1 OAK TANNED

Extra heavy, single and double	30 5%
Standard	[illegible]
Cut leather lacing, No. 1	[illegible]
Leather in sides	[illegible]

TAPES.

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

WASTE.

White	Cents per lb.
XXX Extra	20
Peerless	20
Grand	19
Superior	19
X L C R	18
Atlas	18
X Empire	18
Ideal	17
X press	16

COLORED.

Lion	14½
Standard	13
No. 1	13
Popular	11¾
Keen	10½

WOOL PACKING.

Arrow	25
Axle	20
Anvil	15
Anchor	11

WASHED WIPERS.

Select White	12
Mixed colored	10
Dark colored	05

This list subject to trade discount for quantity.

RUBBER BELTING.

Standard	40%
Best grades	20%

ANODES.

Nickel	.50 to .54
Cobalt	1 75 to 2 00
Copper	[illegible]
Tin	[illegible]
Zinc	[illegible]

Prices Per Lb.

COPPER PRODUCTS.

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	[illegible]
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x28 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base	64 00	60 00
Braziers', in sheets, 6x4 base	55 00	52 00

BRASS.

Brass rods, base ½ in. to 1 in. rd.	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamless	0 58

PLATING SUPPLIES.

Polishing wheels, felt.	3 00
Polishing wheels, bullneck	1 75
Emery in kegs, American	06
Pumice, ground	05
Emery glue	15 to 20
Tripoli composition	04 to 06
Crocus composition	07 to 08
Emery composition	08 to 09
Rouge, silver	.35 to .50
Rouge, powder	.30 to .35

Prices Per Lb.

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$18 00	$18 00
Sheets, 3½ lbs. sq. ft.	18 00	18 00
Sheets, 4 to 6 lbs. sq. ft.	17 50	17 50

Cut sheets ½c per lb. extra.

Cut sheets to size 1c per lb. extra.

PLATING CHEMICALS.

Acid, boracic	$ 15
Acid, hydrochloric	05
Acid, hydrofluoric	14½
Acid, nitric	.10
Acid, sulphuric	06
Ammonia, aqua	08
Ammonium carbonate	15
Ammonium chloride	11
Ammonium hydrosulphuret	.40
Ammonium sulphate	07
Arsenic, white	12
Copper, carbonate, anhy.	.35
Copper, sulphate	17
Cobalt sulphate	70
Iron perchloride	20
Lead acetate	16
Nickel ammonium sulphate	12
Nickel carbonate	35
Nickel sulphate	15
Potassium carbonate	75
Potassium sulphide (substitute)	.26
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.65
Sodium bisulphite	10
Sodium carbonate crystals	05
Sodium cyanide, 127-130%	41
Sodium hydrate	04
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	14
Tin chloride	60
Zinc chloride	60
Zinc sulphate	09

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

BUSINESS in the engineering and steel trade is fairly quiet just now, due to the unsettled conditions in the raw material markets and also on account of the curtailing of munition orders. Iron and steel merchants report business as being dull, and attribute it to the uncertainty prevailing with regard to prices. The trend of prices to lower levels is more pronounced, although the downward movement has not started yet, except in semi-finished steel which has declined. The opinion is generally held that the crest of steel prices has been reached and that recessions may be expected almost any time. It is not likely, however, that there will be any marked change in the situation until some definite announcement has been made at Washington regarding the Government's price-fixing policy. The situation in the pig-iron market is practically unchanged. The output of pig-iron has declined, but the demand is as insistent as ever. There is, however, very little new business, as consumers are expecting lower prices and on account of unsettled conditions are keeping out of the market. Coke prices are holding firm, but the shortage of cars is holding up shipments. The price on soft coal recently fixed by the United States Government may be advanced owing to the opposition on the part of the mine owners. The scrap markets are dull and featureless, while prices have a weaker tendency. The scrap business is dull at the present time, as consumers are not buying. The non-ferrous metal markets are dull and prices for the most part are largely nominal. The price-fixing policy hangs like a cloud over the market and consumers [illegible] in current quotations.

Montreal, [illegible] con-dition that is causing considerable uneasiness among Canadian manufacturers is the [illegible] upon the shipment of steel from the United States. The inability to obtain supplies other than those required for war purposes only has created a situation that may seriously affect the early future outlook for domestic enterprise. Owing to the impossibility of obtaining certain classes of finished steel from Canadian mills, it is imperative that we secure these from American sources, and present conditions are not conducive to that end.

Pig Iron

Little change is noted in the pig iron situation, as the market is still unsettled pending developments in United States Government circles. The American market appears to be developing an easier tendency, as reflected in current quotations; Pittsburgh prices on basic, foundry and malleable showing a decline for the week of $2 per ton. The composite price on pig iron is now $50.96, this being a decline of 40c per ton on last week's quotation. Owing to the inability of getting shipments of coke, furnaces are somewhat handicapped; quotations on Connellsville coke are now $14.50 for prompt furnace, and $15 for foundry. Canadian producers are not yet in a position to place pig iron on the market, and consequently prices are still unavailable.

Steel

An atmosphere of uncertainty still dominates the entire steel situation, as no definite decision has been arrived at with respect to the final fixing of prices and regulation of supplies. It is now expected that the price fixed for steel and other war materials will be on a higher scale than previously supposed, owing to

the fact that a price fixed on a cost-plus-profit basis would practically eliminate the revenue derived from tax placed upon the surplus profits. The present market is one of apparent indifference, as the trade is still undecided as to the future outlook; such activity as is reported seems to be to let things drift rather than open the way for additional business, the disposition being to mark time until the Government takes further action. The situation in the States has shown a downward tendency, which has been reflected in the easier quotations on certain commodities, chiefly on steel bars and tank plates, the Pittsburgh price on the latter having declined over $30 per ton.

The outstanding feature in connection with the Canadian situation is the effect the steel embargo has had upon general conditions and the possibilities that may arise should present restrictions continue. It is not only difficult, but almost impossible to obtain delivery on any other material than that required expressly for war purposes; this is the result of the regulations issued by the American Government whereby a license to ship will only be issued when the material ordered is to be used exclusively for war purposes. While the curtailment in the production of munitions will tend to decrease the steel requirement, this condition will offer little release, as this class of steel has been produced largely at home, and such material as has been required for general domestic purposes has been and will continue to be shipped in from the States; the mills in this country not being in a position to produce the necessary grade. Price quotations in the States indicate an easier market, but local quotations are comparatively unchanged, with prices very firm.

Metals

The general market continues to be more or less unsettled owing to the delayed action on the part of the American authorities respecting an announcement in relation to the fixing of prices and other regulations. When this uncertainty is finally removed it is expected that heavy buying will result, as stocks in many instances are becoming depleted. Copper is affected by speculative rumors. Tin is steady at lower prices. Spelter is unsettled and easier. Lead is easier in New York, but firm here. Antimony and aluminum are inactive and weaker.

Copper.—As the time approaches when an announcement is expected by the American Government respecting the price that will govern the production and sale of copper, the uncertainty of the past few weeks, while none the less pronounced, appears to be changing into an attitude of feverish anxiety respecting the official statement of the authorities. Many conflicting rumors are abroad as to the price to be fixed, and it is the wide variation in these reports that has produced such a nervous condition. While the market is not an active one, there is a certain feeling that heavy buying will be announced as soon as price regulations are definitely set and the period of uncertainty is removed. Firmness is maintained on the New York market with an advance of ½c on electrolytic and castings, the quotations being 28c for lake and 26½c for electro and castings. On a steady but uninteresting market the dealers here report no features, and quotations have remained unchanged; lake and electro are quoted at 33c, and castings at 32c per lb.

Tin.—The market has been of a fluctuating nature during the past week, but has steadied in the last few days, and is now in a firm position. The situation is still influenced by the political uncertainty in the States, as the findings of the various committees will to some extent affect conditions in the tin market. Although the American situation is firm, the New York price of 60¾c is 1⅛c lower than that of last week. The situation here has followed the New York market to some extent, but prices are well maintained at 61½c per lb.

Spelter.—Conditions in the spelter situation are not improving, as producers are apparently reluctant to meet the requirements of the American Government inrespect to their request for supplies, the price for which does not compare favorably with that formerly paid. While surplus stocks are undoubtedly plentiful, these conditions are likely to be affected by the closing down of certain smelters that have been operating at a loss at the present price of spelter. The price of 12c and 12½c announced as the figure to be paid by the Government is 1c lower than that paid for the previous requirements, and it is expected that producers will not respond freely under these conditions. The New York quotation on the open market is slightly over 8c, this being ¼c lower than last week. The market here is not active, but quotations have remained unchanged at 10½c per lb.

Lead.—The market seems to have been influenced by rumors circulated by some selling interests to the effect that futures are much easier; this has somewhat depressed the spot price on the New York market, both the trust and independent price having declined ½c during the week, the base price for both being 10c per lb. Local dealers report steady business, with prices comparatively firm at 13c, but the undertone is easier.

Antimony.—The situation has developed additional weakness owing to the arrival of supplies and the recent inactivity of the market; the latter as a result of the deferred action of the American Government as to the regulation of price and distribution. New York shows a further decline of ⅝c per lb., the current quotation being 14⅜c per lb. On a quiet market prices are inclined to weaken locally, but last week's price of 20c is still maintained.

Aluminum.—The market is rather unsettled and quiet, with a weak undertone developing. New York prices are a little easier, but local dealers report little change and firm prices; local quotations 65c to 67c per lb.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the Commission headquarters are at Ottawa.

Machine Tools and Supplies

The almost total absence of inquiry for munition making machinery would seem to indicate that the activity of shell-making has been reduced to a minimum, those plants that are still so engaged being well supplied with all necessary equipment. The present demand, which is not very brisk, appears to be confined to such machinery as would be used for general engineering purposes, largely for use in shipbuilding plants or marine repair shops. Machine tool activity at the present time is more of a pre-war nature than has been experienced in the past three years; a notable feature being the pronounced falling off in the selling of special machinery for shell-making purposes. This condition, however, does not prevail across the line, as the machine tool industry in the States is at present closely allied to the abnormal activity of two years ago.

Canadian tool builders are having some difficulty in securing delivery of material from the States, as nothing is permitted to be shipped from there in the nature of industrial requirements, unless it is specified that the same is to be used exclusively for war purposes. Despite the decline in the demand for supplies that has naturally followed the curtailment of shell production, activity continues to be of a steady and encouraging character. The easier tendency in the price of raw materials has created a steadier tone in the price of supplies, although some difficulty is still experienced in securing delivery, especially from points in the States.

Scrap

The market in old materials has shown little or no improvement, and may be said to be almost stagnant in respect to actual business; this is due largely to the unsettled condition of other markets as a result of pending developments, the uncertainty of which has seriously affected active trading. The American market in heavy melting steel and low phosphorus scrap is stronger, also borings and turnings, but the general situation in respect to old metals has developed a weaker tendency. Local conditions have a fluctuating tendency, but dealers' prices are practically unchanged, last week's quotations still prevailing.

Toronto, Ont., Sept. 11.—There is less activity so far this month in the iron and steel market than in August, due largely to the unsettled conditions existing in the

trade. Consumers are only buying what they are in urgent need of as they anticipate a general recession in prices. Deliveries are also very slow as it will be some weeks before the Canadian mills can take care of the consuming demand and, on imported steel, licenses have to be obtained, which causes considerable delay. Prospects for cheaper coal are not so bright. The mine owners in the States are protesting against the prices fixed by the U.S. Government recently and it appears highly probable that the prices at the mines will be advanced at least 50c. a ton on soft coal.

Steel

The market continues unsettled owing principally to the U.S. Government's delay in fixing prices. The steel industry is anxiously awaiting an announcement of the Government price-fixing policy. Although rumors are plentiful, no official statement has yet been made to throw any light on the situation. The task is difficult and complicated, which accounts for the delay in arriving at a satisfactory conclusion. In the meantime, however, the market is unsettled and the outlook in the trade uncertain. Business so far this month has been unusually quiet and the former activity in the steel industry seems to have come to a temporary standstill. Consumers are keeping out of the market until the situation becomes more settled and are only buying from hand-to-mouth to satisfy more urgent requirements. Some adjustment has been made in connection with the embargo on importations of steel from the States, and it is likely that the modifications in the original order will materially benefit the trade. Considerable delay and trouble, however, is caused by having to obtain a license on each shipment. There is every indication that prices will likely begin to decline in the near future.

There is no doubt that the crest has been reached and the market cannot stand still for long. Consumers are not now so anxious to place orders as they were at one time and the principal reason for high prices has thus been eliminated. The falling off in demand for steel for munitions has also tended to make the market easier while the price-fixing policy of the U.S. Government is having a similar effect in both the States and Canada. Although deliveries from domestic mills have not yet improved to any material extent, it appears likely that during the coming month or so they will be able to look after their customers better in this respect. The decline in demand for shell steel will release more tonnage for domestic purposes and relieve the shortage which has existed for some time. There are no price changes on domestic products to note this week, although the market is distinctly easier.

The general price level of steel products in the United States continues in tend downwards, but there has been no marked decline as yet except on semi-finished material. The situation in other respects is practically unchanged and the steel industry awaits further developments in the situation at Washington. In the meantime the market is marking time until some definite decision has been made. Government requirements are constantly increasing and, having preference over all other business, private consumers have to get steel when and where they can. The result is that private enterprise is being considerably restricted and only the more urgent work is being put through. Billets are unchanged at last week's levels. The market for black sheets is quiet and unchanged with prices tending downwards. A decline in prices of galvanized sheets is also expected in the near future. The big demand for ship and boiler plate is holding the market firm, but prices are largely nominal. The big demand in prospect for ship plates will keep the mills operating at capacity for a long time to come. The unfilled tonnage of the U.S. Steel Corporation on August 31 was 10,407,049 tons, being a decrease of 437,115 tons over the preceding month.

Pig Iron

The market continues in a very unsettled condition owing to the fear that the price-fixing policy will include pig iron. Apart from this the situation in the market is unchanged. Production is declining owing to shortage of labor and inadequate supply of coke while the furnaces, being behind on deliveries, are being pushed to the limit to fill orders on the books. There is, however, very little new business, as consumers are waiting developments at Washington. The local situation is unchanged, but car shortage is causing considerable uneasiness. The coke market is holding firm with prices practically unchanged.

MARKET LETTER DEVELOPMENT

The attention of metal working plant executives is directed to the enlargement of the scope and usefulness of our Market Letter Department. In New York and Pittsburgh, expert correspondents have been engaged, and are already furnishing each week concise reports of production activities, price movements, etc., within the territory served by each of these important centres. During the next few weeks, further additions will be made to the number of our United States correspondents, embracing other industrial centres, and enlarging thereby the scope of the meantime service being rendered.

Scrap

The market continues stagnant with very little new business being reported. Consumers are still awaiting developments in the situation and there is a general feeling that the market is due for a decline, particularly in copper, brass and lead scrap. Scrap steels and machinery cast iron are holding steady at unchanged prices.

Machine Tools

Another quiet week in the machine tool trade leaves little of importance to be recorded. The machine tool business is undergoing a period of readjustment and the absence of activity is only what might have been expected. The Canadian Car & Foundry Co. are in the market for woodworking and metal working tools for their car plant at Fort William, Ont. What demand there is at the present time is principally for heavier tools. The machine tool market in the States is very active, the dominating feature being Government requirements for shipyards and engine-building plants.

Supplies

The market for machine shop supplies continues fairly active, although business has been affected by the falling off in munitions orders. The demand now is largely for supplies of a general character. Prices are still holding firm and deliveries are as backward as ever.

Metals

Extreme dullnes still characterizes the metal markets. Prices are unchanged at the level prevailing last week, but are largely nominal. The present condition seems likely to exist until some definite announcement is made by the U.S. Government with regard to its price-fixing policy. Until this question is settled there will be no activity in the markets, as consumers will hold off in anticipation of lower prices and only buy to fill urgent requirements.

Copper. — Although there is some scarcity of copper, the market continues easy in spite of large purchases by the U.S. Government. Prices are weak, though it is believed that only a little metal could be bought at prevailing quotations. Local prices are unchanged as follows: Lake and electrolytic 34c and castings 33c per pound.

Tin.—Very little interest is being shown in the tin market at the present time and the market is quiet. Local quotations are unchanged at 64c per pound.

Spelter.—The market continues very unsettled due to the possibility of Government control and prices have a weaker tendency. Spelter is quoted locally at 11c per pound.

Lead.—The Trust have made a new price on lead of 10c New York, the outside market being also at the same figure. This reduction has not had the effect of stimulating business and the market is dull and unsettled. Local price is unchanged at 13c per pound.

Antimony.—The demand for antimony is very light and the market is weaker, although quotations are unchanged in the meantime at 20c per pound.

Aluminum.—The market continues quiet and is weaker through lack of demand. Local price is unchanged at 64c per pound.

New York, Sept. 10.—The urgent demand for high grade shell steel has intensified the demand for electric furnaces. Manufacturers of ammunition and of ordnance who are able to place contracts for such furnaces for deliveries within eight months are particularly fortunate. The Greer interests at Baltimore, who

have recently received large munitions contracts from the United States Government, have placed orders for four 6-ton Heroult electric furnaces with the American Bridge Co. Each furnace will turn out about 30 tons electric steel per day, running 5 heats, making a total of 120 tons per day for the four furnaces.

Manufacturers of airplane engines continue actively in the market for shop equipment to fill additional large orders for both the United States and Allied Governments. The General Vehicle Co., of Long Island City, N.Y., with an exceptionally large contract for airplane engines from the British Government, has put out a sensational inquiry for 900 machine tools, which will cost in the neighborhood of $2,000,000; early deliveries are wanted, specifications calling in some instances for shipments on Nov. 1. The Tregor Motors Corporation has contracts calling for five engines per day. The Simplex Automobile Co.'s list is still pending, with purchases expected at any time and the Standard Aero Corporation of Elizabeth, N.J., will place orders very soon. The General Electric Co., Schenectady, N.Y., is still buying. Walter Scott & Co., holding a gun carriage contract, is still placing orders on its recent list of 200 machines.

The Emergency Fleet Corporation having finally authorized the building of ship plants at Hog Island, Philadelphia and on the Newark (N.J.) Meadows, the American International Corporation and the Submarine Boat Co., who have the ship and yard contracts are on the point of closing contracts for equipment which was practically arranged for several weeks ago. The American Merchants' Shipbuilding Corporation has closed contracts for 24 overhead electric traveling cranes for the equipment of its yards at Bristol, Pa., costing $1,125,000. The Federal Shipbuilding Co. is still placing orders for machinery for its great plant on the Hackensack Meadows. The Newport News Shipbuilding & Drydock Co., and the Lake Torpedo Boat Co., are in the market for machine tools for shipment to Norfolk, Va., and to Bridgeport, Connecticut, respectively. The American Chain Co. will more than double the capacity of its plant at York, Pa. The Standard Steel Works, of Philadelphia, is placing equipment orders for recent additions made to its Burnham plant to provide capacity for the forging and rough-machining of 6-inch howitzers .

The United States Steel Corporation has placed a contract for the building of a huge ingot mold foundry to be built in the Pittsburg district, which will make the Corporation entirely independent of outside sources of supplies. The plant will have a capacity of 80,000 to 100,000 tons of molds per year. With the completion of this foundry, the Corporation will have an annual output of between 300,000 and 400,000 tons of molds. Heretofore, the Carnegie Steel Co. has bought nearly all of the molds it required from independent foundries in the central West, but the Illinois Steel Co. has been casting molds at South Chicago; the Tennessee Coal, Iron & Railroad Co., at Ensley, Ala., and the American Steel & Wire Co., at Cleveland, for years, the output, however, was entirely inadequate to meet the needs of other subsidiary companies. It is the policy of the Steel Corporation to be entirely self-contained in all the numerous branches of the industry, and further heavy expenditures for extensions and improvements may be expected until the organization is fully rounded and entirely independent of outside sources of supply.

Pittsburgh, Sept. 8.—The iron and steel trade, buyers and sellers alike, are disposed to assert that they are waiting upon action by Washington in the matter of price fixing. The quieting down in the market, which began last April, developed into stagnation by the end of June, and lately intensified, is attributed to the waiting attitude. This is merely psychological. It is human nature to pick on one thing as the excuse when a certain line of conduct is followed. Rumors in the past few days have been to the effect that the Government's steel price decision would be announced within a week, but it is quite safe to predict that when the announcement is made the steel market will still halt. There are very few who think the Government has authority to fix steel prices for the general trade, and even if it did, the mills would probably refuse to sell until they ran out of orders. If prices are fixed with respect to Government purchases only, then the trade will wait to see how closely the open market will approach to the Government schedule. While there is a fresh rumor nearly every day, a rough guess would be that the Government prices for the descriptions of steel it needs in largest tonnages will be between one-half and two-thirds of the present quoted market, and thus the market will have a great deal of adjusting to do.

Price Declines

There have been some further declines in the past week, all a part, but probably a very small part, of the general readjustment that has been in progress, in its modest way, for weeks past. Bessemer pig iron became readily available at $50, valley furnaces, and basic iron at $48, representing further declines of $2 a ton and total declines to date of $6. While billet offerings at $75 continued it became the common opinion that on a firm bid some could be had at $70.

The decline in plates, reported a week ago, has not proceeded farther, but instead of 8.00c being now regarded as a cut price, it is rather regarded as the top of the market, except for very small lots.

Merchant steel bars have hitherto been quoted at 4.50c, Pittsburgh, as minimum, but there are rumors of offerings at 3.50c on first quarter contracts, and it is well authenticated that 4.00c can be done on contract, possibly even for the fourth quarter of this year, and a decline of $10 a ton in bars is, therefore, to be placed in the record.

Some of the sheet mills are now able to promise deliveries on new business in about three weeks' time. Roughly speaking, this compares with an offer of six weeks' delivery three weeks ago, which in general would indicate that the mills have been booking very little business meanwhile. It seems certain that some of the mills will have to cut prices within 30 to 60 days in order to maintain operations.

The Export Embargo

Very stringent regulations are being formulated in connection with the granting of licenses for iron and steel exports, and a great deal of business will doubtless be shut off. While tin plate is included in the embargo, as to all countries, it is reported that this does not apply to Canada, on the ground that Canada has an export embargo. There is no authentic news of the progress of diplomatic negotiations with Japan, on which hinge exports of plates, etc., to that country.

Coal and Coke

It remains the case that there are no sales of coal to speak of at the prices fixed by the Government, on the general basis of $2 per net ton at mine for mine-run. The operators state their output is fully taken up by shipments on contract. Some critics express the view that the price fixing is a failure because coal cannot be bought, ignoring the fact that consumers having contracts are receiving shipments on these contracts, which are at much lower prices than the former spot market, which ranged generally from $5 to $6 a ton during the first half of this year, and thus consumers as a class are getting their coal cheaper, although there are some who cannot, perhaps, get coal at all.

The Government has not fixed a general price on coke yet, as it is empowered to do by the Food Control law approved four weeks ago. The trade expects daily that an announcement will be made. Meanwhile, the Government has just alloted 16,000 tons of coke at $3 for furnace or heating grade and $3.50 for foundry grade, for use in the arsenals. The coke operators are accepting their orders without demur, although they consider the price quite low. The open market for prompt shipment is now $13.50 to $14.50 for furnace and $14 to $15 for foundry. There are a number of contracts in force calling for regular deliveries of furnace coke, the price to be adjusted weekly or monthly, according to the spot market, and one such contract for furnace coke was adjusted at $13.50 for the month of August.

Market Prospects

It is generally admitted throughout the trade that iron and steel prices are to decline, and very materially. The blast furnaces admit, as a rule, that they cannot hope any longer to obtain the prices recently charged and which, with some exceptions, still represent the quotable market, although it has become practically nominal. In billets there has already been a decline from $95 to $75, or possibly $70.

How far the readjustment will extend, and when it will be completed, are the uncertain things, and no one ventures to express any definite opinion. As usual when the market has become stagnant

after an extended rise with heavy buying, the steel mills are interested in having their customers continue to take material on contract, and specifications against contracts are stimulated by maintaining high prices as the nominal market even if sales are not affected. When the mills have squeezed out of their contracts all the tonnage they can, they will have to turn their attention to making fresh sales. With some mills this condition may be reached soon. In other cases the mills appear to be sold up tight to the end of the year.

The level to be finally reached for finished steel prices, at which trading can be resumed, will, of course, depend upon the relation between supply and requirements. Productive capacity has been increasing steadily, but is not fully employed on account of coke and labor shortage. Requirements of the ordinary domestic trade are bound to decrease steadily as the country becomes more fully engaged in war work. The tremendous expenditures of the Government are certain to make much business, but the extra work will involve labor and plant facilities hitherto engaged in the fabrication and consumption of steel, and the general industrial activity is likely to impair the country's ability to consume steel more than its ability to produce steel.

TRADE INQUIRIES

TRADE inquiries at the Inquiries Branch Department of Trade and Commerce, Ottawa, include the following:

Ebonite or vulcanite.—A Birmingham firm is open to purchase ebonite (vulcanite) in rods and tubes, 3 foot lengths. Also sheets 48-inch by 20-inch and 24-inch by 20-inch.

Asbestos manufactures.—A Birmingham firm wishes to be put in touch with manufacturers of asbestos goods.

Sheet asbestos.—A Birmingham firm inquires for quotations and samples of sheet asbestos.

Millboard.—A Birmingham firm would like to hear from manufacturers of millboard.

Knitting machinery.—A Leicester firm would like to receive catalogues from any manufacturers of up-to-date knitting machines.

Machinery.—A Leicester firm wishes to hear from manufacturers of brush-making machines and laundry machinery, with a view to representation.

Machine tools.—A Leicester firm is open to represent a Canadian manufacturer of machine tools.

A HIGH speed steel alloy recently patented in Great Britain has the following composition: Carbon, 0.5 to 0.8 per cent.; molybdenum, from 6 to 10 per cent.; chromium, from 3 to 6 per cent.; vanadium, 0.15 to 2 per cent.; manganese, 0.2 to 0.4 per cent., and silicon, 0.2 to 0.4 per cent. The amount of vanadium may be lowered and partly replaced by cobalt, of which latter element from 0.5 to 3.5 per cent. may be incorporated.

Enlarged Canadian Trade Intelligence Service

Under the arrangement made by the Minister of Trade and Commerce with Sir Edward Grey in July, 1912, the Department of Trade and Commerce, Ottawa, is able to present the following list of the more important British Consulates whose officers have been instructed by the Foreign Office to answer inquiries from and give information to Canadians who wish to consult them in reference to trade matters.

BRAZIL—Bahia, British Consul. Rio de Janeiro, British Consul General.

CHILE — Valparaiso, British Consul General.

COLOMBIA — Bagota, British Consul General.

ECUADOR—Quito, British Consul General. Guayquil, British Consul.

EGYPT — Alexandria, British Consul General.

FRANCE—Havre, British Consul General Marseilles, British Consul General.

INDIA—Calcutta, Director General of Commercial Intelligence.

ITALY—Genoa, British Consul General. Milan, British Consul.

MEXICO—Mexico, British Consul General.

NETHERLANDS—Amsterdam, British Consul.

PANAMA—Colon, British Consul. Panama, British Vice-Consul.

PERU—Lima, British Vice-Consul.

PORTUGAL—Lisbon, British Consul.

RUSSIA—Moscow, British Consul General. Petrograd, British Consul, Vladivostock, British Consul. Odessa, British Consul General.

SPAIN—Barcelona, British Consul General. Madrid, British Consul.

SWEDEN—Stockholm, British Consul.

SWITZERLAND—Geneva, British Consul.

URUGUAY—Monte Video, British Vice-Consul.

VENEZUELA — Caracas, British Vice-Consul.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

ARGENTINE REPUBLIC—B. S. Webb, Acting Canadian Trade Commissioner, Reconquista, No. 46, Buenos Aires. Cable address, Canadian.

AUSTRALIA—D. H. Ross, Stock Exchange Building, Melbourne. Cable address, Canadian.

BRITISH WEST INDIES—E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

CHINA—J. W. Ross, 13 Nanking Road, Shanghai. Cable address, Cancoma.

CUBA—Acting Canadian Trade Commissioner, Lonja del Commerci, Apartado 1290, Havana. Cable address, Cantracom.

FRANCE—Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadaconna.

ITALY—W. Mc. Clarke, c/o H. M. Consul, Milan.

JAPAN—B. E. Crowe, Acting Canadian Trade Commissioner, P. O. Box 109, Yokohama. Cable address, Canadian.

HOLLAND—Ph. Geleerd, Acting Canadian Trade Commissioner, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

RUSSIA—C. E. Just, Canadian Government Commercial Agent, Alexandrinskaia, Plosch 9, Petrograd. L. D. Wilgress, Canadian Government Commercial Agent, Bukhgoiza Ulitza No. 4, Omsk, Siberia.

NEWFOUNDLAND—W. W. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

NEW ZEALAND—W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

SOUTH AFRICA—W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

UNITED KINGDOM—Harrison Watson, Sub-division E.C. 2, 73 Basinghall Street, London, E.C., England. Cable address, Sterling, London. N. D. Johnston, Sun Building, Clare Street, Bristol. Cable address, Canadian. J. E. Ray, Central House, Birmingham. Cable address, Canadian. J. Forsyth Smith, 31 North John Street, Liverpool. Cable address, Cantracom. F. A. C. Buckwell, 1 St. Ann's Square, Manchester. Cable address, Cantracom. J. Forsyth Smith, Acting Canadian Trade Commissioner, 87 Union Street, Glasgow, Scotland. Cable address, Contracom.

CANADIAN COMMERCIAL AGENTS

AUSTRALIA—B. Millin, Royal Exchange Building, Sydney, N.S.W.

BRITISH WEST INDIES—Edgar Telgo, Port of Spain, Trinidad. Cable address, Canadian. R. H. Curry, Nassau, Bahamas.

NORWAY AND DENMARK—C. F. Sundt, Grubbegd No. 4, Christiania, Norway. Cable address, Sontums.

SPAIN—J. F. Rovira, Hotel Continental, Barcelona.

CANADIAN HIGH COMMISSIONER'S OFFICE

UNITED KINGDOM—W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England. Cable address, Dominion, London.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

ENGINEERING

Walkerville, Ont.—Fred F. Ferguson, of St. Thomas, Ont., will establish a grey iron foundry here.

Ladysmith, B.C. — The Ladysmith Smelting Corporation will instal a converting plant for treating copper ore.

Quebec, Que.—On September 17 another attempt will be made to complete the famous Quebec bridge on the transcontinental railway by hoisting the centre span into place.

Quebec, Que.—One of the large hoisters for the centre span of the Quebec bridge, slipped from the cantilever arms on Sept. 5, and is now at the bottom of the river with the mass of wreckage from the two previous disasters.

Victoria, B.C.—As a war measure, the Trades and Labor Council meeting here last Thursday endorsed a resolution of the Kamloops Chamber of Commerce asking the Canadian Government to establish plants for handling iron deposits and for their conversion into steel.

Princeton, B.C.—The Canada Copper Co. contemplate opening up a large mine near here. Power to operate the mine will be supplied by the West Kootenay Power and Light Co., while the copper and other products will be smelted and refined by the Consolidated Mining and Smelting Co. at Trail.

Cedars, Que.—The Unit Construction Co., contracting engineers, St. Louis, Mo., will design and construct an addition 600 x 130 x 70 ft. to the power house of the Cedars Rapids hydro-electric development. The construction will be of structural steel and reinforced concrete, and will cost approximately $250,000.

ELECTRICAL

Stratford, Ont.—Work will commence shortly on installing equipment in the hydro sub-station here.

New Toronto, Ont.—The Power & Water Commission has sanctioned the Hydro-Electric Commission's move in changing the distribution system, so that the township and New Toronto would each have a separate sub-station.

MUNICIPAL

Blenheim, Ont.—The Town Council has decided that it will dispose of the former electric power house and contents.

Woodstock, N.B.—The Town Council will instal a filtration plant and improve the pumping plant at a cost of $60,000.

Port Dover, Ont.—The Town Council will proceed with the installation of a waterworks system now that the by-law has carried.

Portage la Prairie, Man.—The Town Council will install a 100 h.p. boiler with mechanical stoker in its electric station at a cost of $5,000.

Welland, Ont.—The Crowland Township Council propose extending the waterworks system, which includes laying water mains.

Melita, Man.—A by-law will be submitted to the ratepayers on September 15 to authorize an issue of debentures for $10,000 for a street lighting system.

New Toronto, Ont.—James, Loudon, & Hertzberg, the town's consulting engineers, have recommended the purchase of a small motor-driven centrifugal pump.

Toronto, Ont.—The Ontario and Municipal Board have approved of plans for the proposed extension of the Bloor Street civic car line from Quebec Avenue to Runnymede.

BUILDING

Montreal, Que.—A permit has been granted William Rutherford & Sons to build a warehouse on Charlevoix Street to cost $6,000.

Montreal, Que.—The Canadian Vickers, Ltd., have taken out a permit for the construction of a reinforced concrete warehouse, 159 x 67 feet, to cost $48,000.

Montreal, Que. — A building permit has been granted J. A. Coulombe for the construction of a factory on Demontigny and Visitation Streets, to cost $9,700.

Toronto, Ont.—The Matthews-Blackwell Co., have received a permit for alterations to their packing plant at the foot of Bathurst street to cost $4,000.

London, Ont.—Negotiations with the Canadian Ajax Co. have been called off and no by-law will be submitted to the citizens. The company proposed to establish a factory for making rubber goods.

Toronto, Ont.—The Toronto Board of Harbor Commissioners have taken out a permit for the erection on Harbor square of an office building. It will be six storeys high and built of reinforced concrete.

TENDERS

Cobalt, Ont.—Tenders will be received until September 18 for installing a complete telephone system. R. L. O'Gorman, town clerk.

Ottawa, Ont.—A. Johnston, Deputy Minister of Marine, is receiving tenders until Sept. 20 for the construction of a fog alarm building at Little Metis Light Station, County of Rimouski, Que. Plans, etc., with Department of Marine, Ottawa.

Charleswood, Man.—Tenders will be received by the undersigned up to Saturday, September 22, 1917, for the drilling of one 5-inch well, and equipping same with pump and platform, on the Arboro Street, West Winnipeg. A. B. Blakely, secretary-treasurer.

Cobalt, Ont.—Tenders will be received up to Sept. 18, for the supply of material and labor necessary in the installation of a complete telephone system in the Town of Cobalt, and in part of the adjoining Township of Coleman. Further particulars will be furnished by R. L. O'Gorman, Town Clerk.

Ottawa, Ont.—Tenders will be received until September 20, for the roofing and sheet metal work required in the reconstruction of the Parliament Buildings. Plans, specifications and any other information required can be obtained at the office of the general contractor, P. Lyall & Sons Construction Co., Ottawa.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, Toronto, up to October 2, for the construction and delivery of stop valves, valve operating pump and special castings, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Moncton, N.B.—Tenders will be received up to Saturday, September 22, for the construction of the substructure of a three-track subway at Trenton, N.S., under the tracks of the Intercolonial Railway. Plans and specifications may be seen at the following locations:—Office of the chief engineer, Department of Railways and Canals, Ottawa, Ont.; office of the chief engineer, Canadian Government Railways, Moncton, N.B.; office of the resident engineer, Canadian Government Railways, New Glasgow. N.S.

Wallaceburgh, Ont.—Tenders will be received up to September 15, for the construction of pump house and dash wheel also installation of engine boiler, etc., and construction of bridges, etc. Tenders will also be received for transformers, motors, poles, line and wiring necessary to drive dash wheel by Hydro. Plans and specifications and all particulars may be obtained by applying to W. G. McGeorge, C.E., Chatham; Archibald McArthur, Tupperville, or William Biden, Wallaceburg, R. R. No. 3.

PERSONAL

R. B. Bennetts, of Tacoma, Wash., has been appointed consulting engineer for the Ladysmith Smelting Corporation, Ladysmith, B.C.

Lieut. H. W. Morris, M. C., at one time chief electrical engineer of the Grand Trunk Railway, Montreal has been killed in action.

Wallace Downey, president of the Downey Shipbuilding Co., New York, and a native of Nova Scotia, was in Sydney, C.B., recently.

F. W. Darby, formerly advertising manager for Beattie Bros., Fergus, Ont.,

has been appointed to a similar position with the Waterous Engine Works, Brantford, Ont.

J. K. McNeillie, general superintendent of the Canadian Government Railways, has resigned, having accepted a position on the Delaware and Hudson Railway, under F. P. Gutelius, formerly manager of the C. G. R.

Thomas Peck president of the Peck Rolling Mills, Montreal, died at Kennebunk Beach, Me., on Sept. 5, aged 75. Mr. Peck had been associated with the steel business all his life and had been president of the concern for the last five years.

H. A. Woods, assistant chief engineer of the Grand Trunk Pacific Railway, has resigned. Mr. Woods was 15 years in the Grand Trunk and Grand Trunk Pacific service, and he was associated with H. H. Kelliher in the construction of the latter railroad.

Capt. Henry Oldenburg, who for almost half a century has sailed the waters of Detroit River, and for the past twenty years has been in command of the Grand Trunk car ferry Lansdowne, died at his home in Windsor, Ont., on September 4. He was sixty-eight years of age.

W. E. Duperow, assistant general passenger agent, Grand Trunk Pacific Railway, Winnipeg, has been made general passenger agent of the G.T.P. and the Canadian Government Railways with headquarters at Winnipeg. Mr. Duperow was born in 1872 at Stratford, Ont., and entered the Grand Trunk service in 1893.

Fred S. Ferguson, manager, and **Thomas Charlton**, foundry superintendent of the Canada Iron Corporation, St. Thomas, Ont., have resigned, and will open the new plant of the Standard Foundry & Supply Co., at Walkerville, Ont. They were each presented with a club bag by the employees of the Canada Iron Corporation last Saturday as a token of regard.

TRADE GOSSIP

U. S. Steel Corporation Tonnage.—Unfilled orders of the United States Steel Corporation on August 31 were 10,407,049 tons, according to the recent monthly statement issued. This is a decrease of 437,115 tons, compared with the orders on July 31.

Ore Movement on Great Lakes.—According to figures issued on September 4 by M. A. Hanna & Co., of Cleveland, Ohio, 10,156,786 tons of ore were carried on the Great Lakes last month. This does not quite equal the record of 10,341,633 made in July.

Victoria, B.C.—To take over and operate the property and plant of the company by which they have been employed, and by which they are still owed $7,000 in wages, is the suggestion made to Hon. Wm. Sloan, Minister of Mines, by the workmen of the Island Coal and Coke Co., of Nicola Valley.

G. T. R. Officials Visit West.—A. W. Smithers, chairman of the Grand Trunk Board of Directors; Howard G. Kelly, general manager; J. E. Dalrymple, vice-president in charge of traffic; and N. H. Macpherson, left Montreal last Tuesday for a tour of inspection of the Grand Trunk Pacific, going out as far as the terminus, Prince Rupert, B.C.

Car Builders Face Steel Problem.—It is understood that the Canadian car builders who have recently obtained orders for 6,000 cars from the Dominion Government may have some difficulty in obtaining the necessary steel, which will have to come from the United States. The companies concerned are the Canadian Car Co., the Eastern Car Co., and the National Steel Car Co.

Biggest Locomotive Completed.—The biggest locomotive in the world has been completed by the Baldwin Locomotive Works, Eddystone plant, Pa. The engine is for the Virginian Railroad, and has 24 driving wheels and six double cylinders. Its weight is 844,000 pounds, with a tractive power of 160,000. The previous largest locomotive was turned out in March for the Erie Railroad, and weighed 612,000 pounds, with a tractive power of 160,000 pounds.

Toronto, Ont.—A new treaty between Canada and the United States regarding the amount of water each side can take from the Niagara River may be drawn up to overcome the difficulty of the serious shortage of power which is being experienced at present. The provincial Hydro-Electric Commission is contemplating the taking of action soon to stop the exporting of power from the Canadian side of the river, but even this will not make up for the shortage.

British Shipbuilding Increase.—Commenting on the rapid increase in shipbuilding to offset losses from the submarine campaign, the Cardiff, Wales, correspondent of the Exchange Telegraph Co., says that two supplements published by Lloyds Shipping Register show that between June 8 and July 17 more than 100 steamers, of which 63 are British, were added to the register. Most of these vessels are of large tonnage. The rate of construction is understood to be increasing rapidly.

U. S. Will Build Large Fleet of Steamers.—A report from Washington, D.C., states that the United States Government will build a great fleet of merchant vessels, from 10,000 to 12,000 tons, capable of attaining a speed of sixteen knots or better. Not less than 150 cargo ships, aggregating from 1,500,000 to 2,000,000 tons, will be built under the new Shipping Board plan, and not one of them will make less than 16 knots an hour, while many of them will be capable of 18 knots or more. Diesel engines will be used as far as is possible.

Halifax, N.S.—The report of Hiram Donkin, Inspector of Mines, and those associated with him in the formal investigation into the cause of the disastrous explosion at No. 2 colliery at New Waterford, N.S., on July 25, in which 65 miners and boys lost their lives has been made public. The disaster, the report says, was due to the escape of an explosive fixed to bring down coal. The explosive escaped as flame down a cleavage and out throughout the mine,

carrying with it matter in a state of ignition, promoting a gas or gases and dust explosion.

Hydro Export Not to be Stopped.—It is understood that the authorities at Ottawa will not permit a complete stoppage of hydro power to the United States as authorized by the Ontario Government. The Dominion Government controls the export licenses and realizes the delicacy of the situation. It will probably be necessary for Great Britain and the United States to revise the treaty now regulating diversion of water from the Niagara river at the Falls. This would eliminate the possibility of reprisals. The U.S. is now allowed to use 20,000 cubic feet a second and Canada 36,000. The U.S. is using its full allotment, while Canada is using about 29,000 cubic feet.

Canadian Vessels in American Trade.—It is figured that Canadian vessels that have entered the trade between American ports on the Great Lakes will move more than half a million tons of ore before their charters expire late this month. The season has been brief but prosperous for Canadian traders who entered American trade. Canadian vessel-owners plan to take early advantage next season of the opportunity offered by the American Government to engage in trade between American ports. Both American and Canadian vessel-owners expect to continue operating late this season, owing to the demand for carriers to move war supplies and foodstuffs.

May Not Move Lake Ships by Welland Canal. — It is reported that the United States Shipping Board's plan to move lake tonnage through the Welland Canal to the seaboard may be abandoned owing, it is stated, to the absence of dock facilities, in which the vessels could be reconstructed after coming through the canal. It will be necessary to cut many of them into sections in order to navigate the locks of the canal. The Shipping Board has communicated with shipping officials at both Montreal and Quebec regarding dock facilities at these ports. Unless docks can be secured in Canada, it is probable that only about twenty steel tugs will be brought to the seaboard from the locks. These vessels can navigate the canal.

MARINE

Toronto, Ont. — The Toronto Ship Building Co., has been given a permit to erect a mill and mould-loft on their property at the foot of Cherry street, at a cost of $8,000.

Halifax, N.S.—The lumber laden steamer from a St. Lawrence River port, which went ashore on Amherst Island, in the Magdalens, on August 27, has been successfully floated, and arrived at Halifax under her own steam.

Ottawa, Ont.—A vote has passed in the House to appropriate $600,000 for the construction of wooden ships in British Columbia. When completed they will trade between Pacific coast ports and Atlantic coast ports.

Liverpool, N.S.—The auxiliary tern schooner Bianca, built by the Gardner Co. of this port, has been placed in commission. The new vessel is 129 feet long, 33 feet beam, and 408 tons gross. She is fitted with a 100 h.p. Fairbanks crude oil engine, and has a speed of 6¼ knots. Capt. Mark Burke, of Carbonear, is in command. The Bianca was built for Bowling Bros., of St. John's, Nfld.

Vancouver, B.C.—This port will have one of the most up-to-date docks on the Pacific Coast when the construction of the new shed at the Government wharf, tenders for which, it is said, will be called for within a few days, is completed. The building of the new shed will be effected from the $110,000 which has been apportioned a few days ago for harbor improvements, and will be 1,000 feet long by 110 feet wide. The plans call for the construction of a five-ton portal pier crane on the west side of the new shed.

Vancouver, B.C.—That Government stores and supply depots are to be soon established on the four-acre tract on Industrial Island, False Creek, Vancouver, which was apportioned to it by the Board of Harbor Commissioners has been reported to the board. One half of the site will be for the Department of Public Works and the other half for the Department of Marine and Fisheries, Government dredges, tugs and other craft will be loaded at the island in future, it is expected. The acquisition of the tract by the Government places Vancouver on a par with New Westminster and Victoria in this respect, as before the plot had been donated the Government had not a foot of land in the city on which to build a supply depot.

GENERAL

Calgary, Alta.—The Alberta Flour Mills Co. will build a large mill here, to cost approximately $1,500,000.

Montreal, Que.—The Tetrault Shoe Mfg. Co. will build a shoe factory at Maisonneuve at a cost of $150,000.

Peterborough, Ont.—A by-law granting a fixed assessment of municipal and business taxes to B. F. Ackerman, Son & Co. was carried on Thursday by a majority of 580 votes. A shoe factory will be established by the company. For some years past the company has carried on an extensive harness manufacturing business.

CONTRACTS

Oshawa, Ont.—A contract has been awarded to the Chapman Valve Mfg. Co., Toronto, for the valves required for the filtration plant being built here.

Tilsonburg, Ont.—The gentral contract for the construction of the Maple Leaf Harvester and Tool Co. factory has been let to A. F. Ponsford, Ltd., of St. Thomas, Ont. The contract price is $50,000.

Hamilton, Ont.—General contract for the Steel Company of Canada's coke oven plant to be erected here has been awarded to the Wilnute Coke Oven Corporation, New York. The cost will be about $1,500,000.

Yorkton, Sask.—The Siemens Co. of Canada, Ltd., Montreal, have been awarded a contract for a generator to be direct

connected to a Diesel engine. The generator will be 400 k.v.a., 60-cycle, 3-phase, 220 volt. A direct connected exciter is also included in the contract.

WOODWORKING

St. Mary's, Ont.—The St. Mary's Wood Specialty Co., propose installing an additional steam unit in their power plant.

Port Colborne, Ont.—Augustine & Son's planing mill was destroyed by fire recently, the loss being estimated at $10,000.

REFRIGERATION

Toronto, Ont.—Hon. F. G. Macdiarmid, Minister of Public Works, announced the other day that a beginning had been made on construction of the necessary plant at Lakes Nipissing and Nepigon for the handling of fish caught in those waters under the new fisheries plan of the province. Mr. Macdiarmid expects that fishing operations will start before the end of the present month, or as soon as the facilities for storage are completed.

INCORPORATIONS

The Murray Engines, Ltd., Vancouver, B.C., has been incorporated with a capital stock of $25,000 to manufacture machinery, tools, etc.

The Merchants' Shipbuilding Corporation, Ltd., has been incorporated with a capital stock of $500,000, and will establish a shipbuilding plant at Vancouver, B.C.

The Shaft & Tunnel Contract Co. has been incorporated at Toronto with a capital of $40,000 to carry on the business of engineers and contractors at Toronto. The provisional directors are: E. L. Middleton, T. L. Monahan, and A. E. Knox, all of Toronto.

Canadian Coil Co. has been incorporated at Toronto, with a capital of $40,000, to manufacture spark and ignition coils and electrical goods at Walkerville, Ont. The provisional directors are: C. C. Cleverdon, H. E. Westerdale, of Detroit, Mich., and J. R. Cleverdon, of Windsor, Ont.

RAILWAYS—BRIDGES

Ottawa, Ont.—The purchase by the Dominion Government of the Quebec and Saguenay Railway for the Megantic and Lotbiniere, and the Charlevoix and Montmorency Railway has been decided upon. The total cost will be $3,600,000

CATALOGUES

Machine Tools.—Leaflet showing three types of lathe built by the Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.

Skinner Chucks is the title of catalogue and price list No. 30, recently issued by the Skinner Chuck Co., New Britain, Conn. to supersede all previous catalogues and price lists. The catalogue [illegible] embody

made to meet the present day requirements of the trade.

Steam Pumps.—A 90 page catalogue No. 12, issued by the Smart-Turner Machine Co., Hamilton, Ont., is devoted to steam pumps and covers only the designs and sizes ordinarily called for. The catalogue, however, deals with a varied line and includes pumps for practically all purposes. Each type is illustrated, while tables are included, giving sizes and capacities, etc. The concluding pages contain useful hydraulic tables, directions for installing and operating Smart-Turner pumps, and also directions for setting steam slide valves of the duplex pumps.

BOOK REVIEW

Blast-Furnace Construction in America, by J. E. Johnson, Jr., 415 pages, 9½ x 6 in., 247 illustrations. Published by McGraw-Hill Book Co., Inc., New York. Price $4 net. In view of the immense and ever increasing importance of the iron and steel industry, the great activity in blast-furnace work during the past three years, and the problems which still face the blast-furnace operator, a work of the nature of this volume is of very timely occurrence to the trade in particular and the engineering world in general. The author justifies his action by the fact that in nearly half a century no comprehensive book on this subject has appeared in any language. As indicated by the title, the book deals exclusively with American practice, the author acknowledging that his limited acquaintance with foreign practice did not permit him to treat such work from the personal standpoint desired. In the ten chapters which constitute the volume, the subject matter follows the lines indicated by the title, preceded by a brief introduction which clarifies the viewpoint from which the author has handled the subject. The classification of furnaces according to fuels used, and the definition of essential plant features are dealt with, following which the regular chapters take up the problems of handling material, power plants, stoves, stacks and gas plant, followed by plant auxiliaries and a discussion of the dry blast. The text is illustrated by numerous scale drawings and half tone engravings. As a book of reference the volume should be of considerable value to blast-furnace operators and equipment engineers; the question of principle, operation and products are reserved, however, for a second volume which is promised at an early date.

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Cut it out now and place with letters to be answered.

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FOR SALE

A PAYING PROPOSITION FOR RAILROADS or manufacturers. Wish to sell our Canadian rights with fixtures. Address Frank Bayless, 311 Fair Street, Springfield, Ohio. c9m

FOR SALE — 1 LEES-BRADNER THREAD miller, equipped for threading nose and base of 6" shells. Apply The Hayes Wheel Co., Chatham, Ontario. c9m

SECOND-HAND 26" NEWTON TYPE COLD saw cutting-off machine, arranged for motor belt drive and complete, with or without motor. Price $600.00, cars Sherbrooke. MacKinnon, Holmes & Co., Limited, Sherbrooke, Quebec. c10m

ONE ARMINGTON & SIMS 10" x 12" HIGH speed engine, belted to one Westinghouse Electric Mfg. Co. direct current generator, 40 K.W., 550 volts, 75 amps.; speed 910 r.p.m.; also 40' 0"-10" double leather belting; all in good condition. Armstrong, Whitworth of Canada, Limited, Montreal, Que. c6m

FOR SALE—1 NEW 25 H.P. HOR. TUBULAR boiler, 1 second-hand 12 H.P. hor. tubular boiler, tested to 150 lbs.; 1 second-hand 50 H.P. loc. boiler; 1 second-hand Leonard 12 x 12 high speed engine; 1 second-hand 500-lb. belt-driven Beaudry power hammer, only in use two months; in perfect condition. Canadian Engineering & Mfg. Co., 128 Bleury St., Montreal, Que. c9m

FOR SALE—THE TORONTO ELECTRIC COMmissioners have for sale a quantity of second-hand 60-cycle meters and transformers recently in service, also quantity of electrical supplies. List of material and full particulars may be obtained on application to the Purchasing Agent, 15 Wilton Avenue. The quantities are not guaranteed, and all are subject to prior sale. No tender necessarily accepted. Toronto Hydro-Electric System, 226 Yonge St., Toronto. e7m

HYDRAULIC EQUIPMENT FOR SALE.—The equipment listed below is in first-class shape having only been used about three months. Blue prints and specifications and foundations drawings will be furnished. 2—14 x 12 x 5" Fairbanks-Morse duplex steam driven high pressure pumps at 80 gals. per minute capacity each against 600 lbs. pressure, steam pressure 150 lbs. 1—Weighted Accumulator good for 1000 lbs. per sq. inch, 16" diameter, plunger 11 ft. stroke with squeezing water cushion and wooden outside bumper blocks. The tank for the weighting material surrounding the cylinder is 10' 7" in diameter and 11' 0" high. 1—Return Suction Tank for above pumps and accumulator. Height, 9' 0", diameter 8' 0". Capacity, 2700 Imperial gallons. This equipment can be shipped immediately and is open for inspection at the company's plant. Prices on application. The Canadian Copper Company, Copper Cliff, Ont. c8m

SPECIAL MACHINERY

H. C. THOMAS, GENERAL MACHINE SHOP, tools, jigs and machine repairs. 301 King St. W., Toronto. Telephone Adelaide 3836. tf

MANUFACTURERS—WE CAN UNDERTAKE work to any specification—munition production equipment or otherwise. Write W. H. Sumbling Machinery Co., 7 St. Mary St., Toronto

SITUATIONS WANTED

TOOL MAKER — ACCURATE, GOOD draughtsman desires responsible position. Box 330, Canadian Machinery. c14m

A PRACTICAL MACHINE SHOP SUPERINtendent of broad experience in Canada and States will be open for position as superintendent or general foreman, July 15th. A1 references. Address Producer, Box 321, Canadian Machinery. c3m

MACHINE SHOP FOREMAN DESIRES change as shop foreman or master mechanic. Acquainted with scientific management; 26 years' experience. Box 328 Canadian Machinery. c11m

A PRACTICAL MACHINE SHOP SUPERINtendent of broad experience in Canada and States wants position as superintendent or general foreman. Large or small shop on ammunition or machinery; A1 references. Address Box 327, Canadian Machinery. c9m

EMPLOYMENT AGENT OR EMPLOYEEinterviewer position. Lady, middle-aged, possessing keen discernment, educated above the average, good correspondent (shorthand writer, typist), desires position as above with large firm of engineers or any factory, to interview employees and referees. Moderate salary desired. Toronto Engineering Agency, 57 Queen W., Toronto.

WANTED

WANTED—SMALL SECOND-HAND POWER press, in good condition. Hosmer Stamping & Die Works, Ltd., 831 Dundas St., Toronto, Ont. c13m

WANTED—SECOND-HAND POWER SQUARing shear to cut No. 10 gauge steel up to 24" wide. Must be in good working condition. Packard Electric Company, St. Catharines, Ont. c4m

SITUATIONS VACANT

MAN WANTED TO ACT AS SUPERINTENDent of a fast growing die and stamping plant in City of Toronto. Box 329, Canadian Machinery. c12m

NIGHT SUPERINTENDENT FOR SHELL MAchinery plant in Western Canada; knowledge of four point five shell and good all-round experience essential. Write, stating qualifications, salary and references, otherwise application will not be considered. Box 325, Canadian Machinery. c6m

FOREMAN WANTED—FOR SHOP IN CENtre of Toronto, with up-to-date equipment, employing about thirty men, doing jobbing business and making fine special machinery and tools. When applying state experience and give references, also wages expected. Only first-class men need apply. Box 326, Canadian Machinery. c8m

FOR SALE

4—No. 2 Foster Plain Head Screw Machines and 2—No. 3 Foster Friction Head Screw Machines all completely equipped with air cylinders and air chucks suitable for use on No. 80 Time Fuse Bodies. These machines have never been used. Also one Graduating Machine made by the American Ammunition Co.

For full particulars apply the

Holden Morgan Thread Miller Limited

Toronto, Ontario

c14m

FOR SALE

4—14 x 6 Flather Engine Lathes, C.R., Q.C.G., new.

4—14 x 5 Reed Engine Lathes, R. & F.

3—18 x 8 Davis Engine Lathes, D.B.G.

1—18 x 10 Rahn-Larmon Engine Lathe, new.

1—18 x 12 Rahn-Larmon Engine Lathe, new.

1—22" x 10' Nicholson & Waterman Engine Lathe.

1—No. 13 B. & S. Automatic Gear Cutter.

1—30" Newark Automatic Gear Cutter.

1—5 x 48 Pratt & Whitney Plain Grinder.

1—No. 2 Bath Universal Grinder.

1—12 x 60 Modern Plain Grinder, new.

2—Lees-Bradner Thread Millers.

1—30 x 30 x 8' Powell Planer, new.

Brownell Machinery Co.
Providence, R. I.

[illegible] interests you, tear it out now and place with letters to be answered.

LOOK—HERE THEY ARE

BORING AND TURNING MACHINES—VERTICAL.

1—30" Bullard, 1 turret head.
1—30" Flather, one turret head.
1—36" Bausch, 2 swivel heads.
2—36" Brown & Sharpe, one turret head, Dec. delivery.
[illegible]
1—New 42" Gisholt [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
1—90" Vertical Cylinder.

[illegible] MACHINES HORIZONTAL.

[illegible]
[illegible] Barber 3⅛" bar type.
[illegible] 2 facing heads.
[illegible] table.

BULLDOZERS.

[illegible] as No. 4 Williams
[illegible] strike.
[illegible] & [illegible] belt drive.
[illegible] & [illegible] belt drive.
[illegible] & [illegible] belt drive.

COMPRESSORS AIR

[illegible] x 14½ x 8".
[illegible] two-stage, 790 cu. ft.
[illegible] Chicago Pneumatic, belt-driven.
[illegible] Single Cylinder Smith Valle, [illegible]
[illegible] Ingersoll-Rand, motor driven.

CRANES.

[illegible]
1—50 ton [illegible] span.
1—Locomotive, 35' boom, standard gaged, steam driven.

CUTTING-OFF MACHINES.

2—No. 00 Brown & Sharpe.
1—2" Cataract Warner & Swasey
4—3½" Hall.
10—4½" Williams.
3—4" Curtis & Curtis.

DRILLING MACHINES—RADIAL.

2—New 2' American, cone drive.
1—3' Bickford, semi-Universal table.
1—3' Bickford, gear drive.
3—New 3' Americans, sensitive tapping attach.
1—New 3' Mueller, plain speed, box drive.
1—New 3½' Western Drill, 86" circle.
2—4' Mueller, plain, speed box drive.
1—5' semi-universal American.
1—6½' American full Universal.
1—New 6' Triumph, motor drive, Sept. del.

DRILLING MACHINES—HEAVY DUTY

4—No. 310 Baker Brothers.
2—New No. 2 Colburn.
3—No. 14 Colburn, 24" swing, capacity 2" in solid steel.
2—D3 Colburn, plain table.
4—No. 310 Baker, single pulley drive, late type.

DRILLING MACHINES MULTIPLE SPINDLE

4—New Leland Gifford, sensitive, four spindle.
1—No. 30C Baush, 12 spindle, capacity 1⅛" holes, 30" circle.
1—14-spindle Baush, capacity [illegible] holes, 36" circle.

GEAR CUTTING MACHINES

1—No. 1 Whiton.
1—No. 3 Barber-Colman Hobber.
1—No. 3 Bement Gear Rack Planer, delivery 60 days.
1—No. 3 Brown & Sharpe Aut. Gear Cutter, Spur.
1—New 6" Standard Gear Cutter, Spur.
1—[illegible] Gleason Bevel Gear [illegible]
1—15" Gleason Bevel Gear Planer.
1—16" Bilgram Bevel Gear Generator.
1—[illegible] Gear Hobber.
1—No. 1 [illegible] & [illegible] Gear Hobber.
1—[illegible] G. & E. Spur and Bevel Cutter.
1—[illegible] Fellows Gear Shaper.
1—24 x 8" G. & E. for Spur and Bevel.
1—24" Becker Brainard.
1—New Flather, solid pattern, 30" Automatic Gear Cutter.
1—New No. [illegible] Bevel 30", Spur 34".
3—36" Fellows Gear Shapers.

GRINDERS UNIVERSAL FOR CUTTERS DRILLS REAMERS ETC.

1—No. 1 Cincinnati.
1—New Norton No. 1.
1—New Walker [illegible]
1—New Walker No. 2, outfit K (capacity 9" x 26")
1—New Wilmarth & Morman, style B.K.
8—No. 190 Wells.
1—[illegible]

GRINDING MACHINES CYLINDRICAL PLAIN.

1—New No. [illegible] delivery.
1—New [illegible]
1—New [illegible]
1—New 10 x [illegible]
1—10" x 60" Landis.
1—New [illegible] x 72 Norton, Plain.
3—[illegible] x [illegible] Modern, self contained.
1—[illegible] x [illegible] Landis, rebuilt.
[illegible] x 36" Modern, self contained, motor or belt driven.
2—[illegible] x 42" Landis, self contained.
1—12" x 48" Modern, self contained, motor driven.
1—[illegible] x [illegible] Landis, with crank grinding.
1—[illegible] x 30" Brown & Sharpe.

GRINDING MACHINES CYLINDRICAL UNIVERSAL.

1—Brown & Sharpe No. [illegible], 8" x 24"
1—New No. 2 Bath, 9" x 20".
1—No. 2 New Walker, 9" x 26".
1—No. 1½ (10" x 30") Landis.
1—New No. 2½ (10" x 30") Bath.
1—[illegible] x 42" Modern.
9—New No. 2 Morse, cap. 12" x 30", Universal Nov. delivery.
1—No. 3 (12" x 40") Brown & Sharpe.
1—[illegible] x 42" Landis.
2—New No. 3 Modern, 13" x 40", Sept. delivery.

GRINDERS—INTERNAL.

1—No. 1½ Landis.
1—No. 70 Heald.
1—No. 75 Heald.

GRINDERS—CYLINDER.

1—No. 27 Brown & Sharpe.
1—No. 60 Heald, single pulley drive.

GRINDERS—PROFILE.

1—New Cleveland.

GRINDERS—RING.

1—New No. 14 Beasley, two-ring chucks.
1—No. 200 Heald.
1—No. 210 Heald.

GRINDERS—SURFACE.

1—New No. 1 Wilmarth & Morman.
1—No. 1 Diamond, capacity 12" x 12" x 24", automatic.
2—New No. 1½ Walker's, complete.
4—New No. 2 Reid (same as B. & S.).
1—New No. 2 Brown & Sharpe.

HAMMERS—POWER—FORGING.

1—40 lb. Bradley Helve.
1—150 lb. Bradley Helve, upright.

HAMMERS—BOARD LIFT—DROP.

1—400 lb. Billings & Spencer.
1—2,000-lb. Chambersburg.

HAMMERS—STEAM—FORGING.

1—Used 600-lb. Niles Single Frame.
1—350-lb. Bell Single Frame Hammer.
1—[illegible] Morgan & Williams, 600 to 800 lbs., 21" cap.
1—New 2,000 lbs. Morgan Single Frame.
1—3,000 lbs. Morgan Double Frame.

KEYSEATERS.

1—No. 0 Mitts & Merrill.
1—No. 2 Mitts & Merrill.
1—60" stroke Compton Knowles Broacher.

LATHES—MANUFACTURING—NOT SCREW CUTTING.

2—New No. 3 Hendey Brothers Bench Lathes.
14—Reed-Prentice Shell Lathes, for 4" or 18 lbs. American shells.
70—New Simplex, 16" x 8'.
[illegible] 2X Reed-Prentice semi-automatic.
40—14" x 6' Reed Stud and Bolt.
[illegible] x [illegible] Fairbanks-Morse, heavy duty.
[illegible] x 8 Simplex, Single Pulley Drive.
[illegible] x 8' Battle Creek, heavy duty.
[illegible] x 8' Mershon.
50—20" x 10' Hindman, high duty.

LATHES—ENGINE.

1—8" Wade Precision; September delivery.
[illegible] x [illegible] Bradford, taper attachment.
1—New Hardinge Brothers 15" Precision Lathe, [illegible] page 35, third catalogue.
[illegible] Cleveland Tool Room Lathes, complete equipment.
2—16" x 6' LeBlond, pan bed, quick-change gears, taper attachment.
1—New 17" x 8' National, quick-change gears.
[illegible] Lodge & Shipley, geared head, taper [illegible]
1—18 x 10 Hendey, quick-change gear, 14" chuck.
1—New 19" x 8' LeBlond, heavy duty.
22—20" x 8' Lodge & Shipley, quick change gear.
[illegible]
[illegible]
25—New 21" x 10' Porter, single back geared.
[illegible] double back geared, Q. C. G.
[illegible] x 10' [illegible]
[illegible] x 10' Reed.
[illegible] & B.
[illegible] quick change.
[illegible] Lodge & Shipley, patent head.
1—34" x 34 Perkins, single back geared, raising blocks to 40", 18" chuck.
1—36" x 45" x 22' McCabe, double spindle.
1—[illegible] New Haven.
1—[illegible] Patent Head Lodge & Shipley, double back geared.
1—[illegible] New Haven, single back geared.
1—[illegible] Schumacher & Boye.
1—New [illegible] American, Double Back Gears, Quick Change.
[illegible] Pittsburg pattern.
[illegible] Putnam, triple geared.
[illegible] American, Gear Head, Quick Change.
[illegible] triple geared.

LATHES TURRET

1—[illegible] Jones & Lamson, geared sliding head.
[illegible] Jones & Lamson.
[illegible] Potter & Johnson.
1—New 24" Gisholt.
[illegible] Gisholt.
1—24" Sibley.

MILLING MACHINES KNEE TYPE UNIVERSAL.

1—No. 2 Kempsmith, 13", dividing head.
1—No. 2 Kempsmith, vertical attachment.
1—New Kempsmith.
1—No. 2 Kempsmith, back geared.
2—No. 3 Cincinnati, late model; almost new.
1—New No. 3 Kempsmith.
2—New No. 3 Becker, August delivery.
1—New No. 4 LeBlond, heavy duty, immediate.

MILLING MACHINES KNEE TYPE—PLAIN

1—No. 0 Pratt & Whitney.
1—New No. 1 Brown & Sharpe.
2—New No. 1 Kempsmith.
2—New No. 1½ American, back gear.
1—New No. 2 Rockford.
2—New No. 3 Kempsmith.
1—No. 3 LeBlond.
1—No. 4 Brown & Sharpe.
1—No. 4 Garvin.

MILLING MACHINES VERTICAL.

1—New Bickett, No. 0.
4—New No. 4B Becker.
2—No. 5 Becker.

MILLING MACHINES PLANER TYPE.

1—Ingersoll Slab 16" x 48" cap.
1—Bement Miles heavy duty planer type 30"x24"x12'.
1—No. 2 Beaman & Smith Vertical Spindle Open-side.
2—Ingersoll Slab Millers, working surface of table 60" x 20".
1—No. 4 Beaman & Smith, vertical spindle, open side, working surface of table 120" x 24", removable housing on one side.

PLANERS

1—24" x 24" x 6' Gray, one head on cross rail.
1—24" x 24" x [illegible] Cincinnati, one head, used three months.
1—25" x 25" x 8' Gray, one head on cross rail.
1—30" x 30" x 8' Gale Planer, one head.
1—30" x 30" x 12' Cincinnati, two heads.
1—[illegible] New Haven, one head.
New [illegible] Bickett, one head; January delivery; additional heads if desired.
2—New [illegible] x 30" x 12' Woodward & Powell, two heads on cross rail, one side head; Oct. delivery.
1—36" x 36" x 12' Gray, two heads.
1—[illegible] x 14' Sellers, four heads.
1—40" x 40" x [illegible] Niles, four heads.
1—Gray, 42", widened to 56" x 42" x 16, two heads.
1—44" x 44" x 10' L. W. Pond, swivel heads.
New [illegible] Bickett [illegible] if desired.
[illegible]
[illegible] two heads, right angle drive.
[illegible] Woodward & Powell, 2 heads.
[illegible]
1—32' 6 Niles Plate Planer.

SCREW MACHINES AUTOMATIC

[illegible] National Acme.
1—No. 515 National Acme.
[illegible] National Acme.
[illegible] National Acme.

SHAPERS

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
1—30" Walcott Gear Drive.

SLOTTERS

[illegible] Bement Gear.
[illegible] New [illegible]

W. F. DAVIS MACHINE TOOL COMPANY

CHICAGO, ILL.	CINCINNATI, OHIO	CLEVELAND, OHIO	NEW YORK CITY
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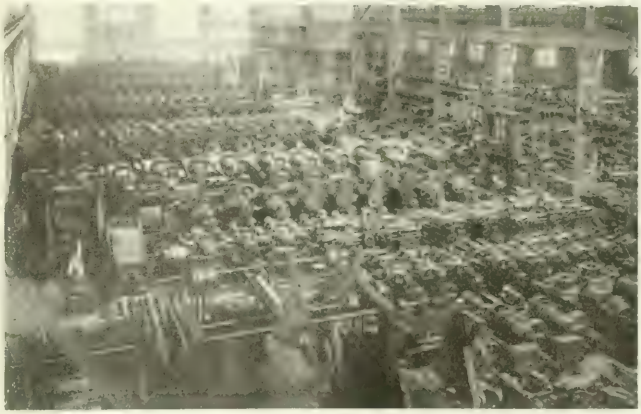
300 MACHINES LATEST MODELS--OVER 300 OTHERS BUT SLIGHTLY OLDER



90% of these machines are very latest models and can be inspected at our plant at Chicago. Photo taken Aug. 25.

ENGINE LATHES—Latest Models.

24—22" x 8' Hamilton, D.B.G., C.R., Semi-Q.C.
5—22" x 8' Hamilton, D.B.G., Turret tool post,
4—22" x 8' Davenport, D.B.G., Turret tool post,
7—22" x 10' Hamilton, D.B.G., C.R., Semi-Q.C.G.,
2—22" x 10' Hamilton, D. B. G., turret tool post, Semi-Q.C.G.,
20—22" x 10' Davis, D.B.G., C.R., Q.C.G.,
6—24" x 10' Lodge & Shipley, D.B.G., C.R., Q.C.G.,
8—24" x 10' Lodge & Shipley, Selective Gd. Hd., C.R., Q.C.G.,
11—26" x 10' American, D.B.G., C.R., and carriage turret, Q.C.G.,
2—26" x 10' American, D.B.G., Carriage turret,
19—26" x 12' Putnam, carriage turret, semi-Q.C.
9—26" x 12' Putnam, C.R., Semi-Q.C.,
2—26" x 12' Wickes, D.B.G., C.R., Semi-Q.C.G.,
10—28" x 10' Niles, Bement, Pond, D.B.G., Q.C.G.
4—28" x 14' Lodge & Shipley, Select. Gd. Hd., motor drive, C.R., turret and taper.
3—30" x 16' Lodge & Shipley, D.B.G., C.R., turret and taper,
10—40" x 18' Pittsburgh, triple geared, Q.C.G.,

TURRET MACHINES—Latest Models.

13—24" Gisholts, 4½" hole, 3-step, 4" belt.

OUR GUARANTEE

Your money back if you return a machine within 30 days from date of shipment, freight prepaid.

NO EXCUSES NECESSARY.

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1 No. 50 Perkins Inclinable.
1 No. 5 Niagara Inclinable.
1 No. [illegible] Consolidated Inclinable.
1 No. 20-F Ryerson Punch.
1 Trimming Press.
2 No. 74 Niagara Trimming Presses.
1 No. [illegible] B Niagara Toggle Press.
1 No. 15 Williams & White Double End Punch.

GEAR CUTTERS.

1—Schuchardt & Schutte Spiral.
1 No. 12 Brown & Sharpe Spur and Bevel
1 No. 1 Brown & Sharpe Spur and Bevel.
1 24" Fellows Shaper.
2 No. 2 No. Cincinnati Spur.
1—36" Fellows Shaper.
1 36" Gleason Spur and Bevel Gear Planer.
1—84"-96" Gleason Spur and Bevel.

MILLING MACHINES

2 No. 5 Brainard.
1 No. 3 Brainard Plain.
1 No. 20 Oesterlein Universal.
1 No. 14½ Brown & Sharpe Universal.
1 No. 25 Becker Plain.
1 No. 2 Cincinnati Universal.
1 No. 2 Schuchardt & Schutte Plain.
1 No. 2 Pratt & Whitney Lincoln.
1 60 x 18" x 8" Internal Seab.
1—Beaman & Smith, 2 vert. hds., 1 hor. cross bor. hd.
1—No. 2 Beaman & Smith Combination Hor. and Vert.

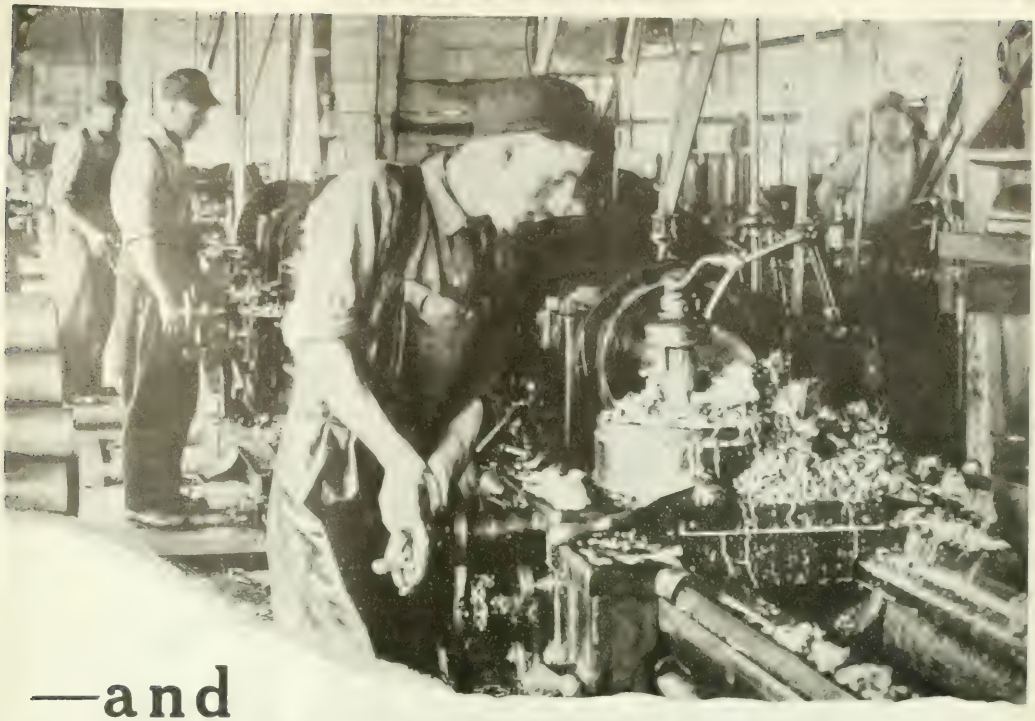
PLANERS

1 -22" x 22" x 5' Flather.
1 -24" x 24" x 4' Gray.
1 -24" x 24" x 6' Cincinnati.
1 -24" x 24" x 10' Lodge & Davis.
1 -26" x 26" x 6' American.
1 -26" x 26" x 7' Gray.
1 -26" x 26" x 7' Gray, 1 head.
1—30" x 30" x 7' Powell, 4 heads.
1 x 10' Gray, 2 heads
1 x 16' Fetel, 2 heads.

HILL, CLARKE & CO. OF CHICAGO

625 WASHINGTON BLVD., CHICAGO, ILL.

If any item interests you, tear it out now and place with letters to be answered.



—and Every Chuck a Hannifin!

PHOTO shows a long line of lathes on six-inch shells —all equipped with Hannifin Air Chucks. This plant has been turning out more shells per machine than any other in its vicinity, and the fact that Hannifin chucks have been used exclusively gives us a certain degree of justifiable pride.

That our claims for increased production with a Hannifin have been substantiated by the records of many Canadian munition plants is good reason why you should investigate them.

The Hannifin Chuck is almost instantaneous in action, holds securely, cannot slip, saves time and labor. The work is chucked and rigidly gripped by simply turning a lever. Another turn effects the release. With the introduction of female labor and skilled male help almost unobtainable, Hannifin chucks will save delays and make-overs by means of these time and labor-saving features.

Our catalog will tell you more about this chuck. Send for it to-day.

Hannifin Manufacturing Co.

CHICAGO, ILL., U.S.A.

REPRESENTATIVES: [illegible] Co., Chicago; Coats Machine Tool Co., New York City; A. R. Williams Machinery Co., Toronto; Williams & Wilson, Montreal; The Canadian Fairbanks-Morse Co., Montreal. EUROPEAN REPRESENTATIVES:— [illegible] Co., Paris; [illegible] & Co., Petrograd.

If any advertisement interests you, tear it out now and place with letters to be answered.

If anything in this issue interests you, tear it out now and place with letters to be answered.

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Canadian Machinery BUYERS DIRECTORY

If you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the ... index facing the inside back cover, after having secured advertisers' names from this directory. The ... desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

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ACETYLENE

ACETYLENE GENERATORS

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BELTING, LEATHER

BELTING, STITCHED COTTON DUCK

BENCH LEGS, STEEL

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BENDING MACHINERY

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BLOW PIPES AND REGULATORS

BLUE PRINTING MACHINERY

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BOLT CUTTERS AND NUT TAPERS

BOLTS

BOLT AND NUT MACHINERY

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BORING MACHINES, UPRIGHT AND HORIZONTAL

BORING MACHINES, STOVE AND COAL

BORING AND TURNING MILLS

BOXES, STEEL SHOP AND TOTE

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Whiting Foundry Equipment Co., Harvey, Ill.

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John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.

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Bellevue Industrial Furnace Co., Detroit, Mich.
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Oven Equipment & Mfg. Co., New Haven, Conn.

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Parmenter & Bulloch Co., Gananoque.

CANNERS' MACHINERY
Bliss, E. W., Co., Brooklyn, N.Y.
Fortunate Mach. Co., Bridgeton, N.J.
Brown, Boggs & Co., Hamilton, Can.
Prest-O-Lite Co., Inc., Toronto, Ont.

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Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cumming & Son, J. W., New Glasgow, Canada.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Belleville, Ont.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

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Dillon Mfg. Co., Oshawa, Ont.

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Blackall, Fred. S., Woolworth Tower, New York.
Bliss Co., E. W., Brooklyn, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.

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Alexander Fleck, Ltd., Ottawa.
Gardiner, Robt., & Son, Montreal.
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Cumming & Son, W. C., New Glasgow, Canada.

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Hull Iron & Steel Foundries, Ltd., Hull, Que.

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Gardner, Robt., & Son, Montreal.
H. W. Petrie, Toronto.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

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John Bertram & Sons Co., Dundas.
Gardner, Robt., & Son, Montreal.
Hurlbut, Rogers Mach. Co., South Sudbury, Mass.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
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Ford Chain Block & Mfg. Co., Philadelphia, Pa.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
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H. W. Petrie, Toronto.
Wright Mfg. Co., Lisbon, Ohio.

CHEMISTS
Can. Inspection & Testing Lab., Montreal, Que.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Toronto Testing Laboratory, Ltd., Toronto.

CHESTS, TOOL
Union Tool Chest Works, Rochester, N.Y.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.
Hannifin Mfg. Co., Chicago, Ill.

CHUCKS, AIR
Hannifin Mfg. Co., Chicago, Ill.
Manufacturers Equipment Co., Chicago, Ill.

CHUCKS, COLLET
Hannifin Mfg. Co., Chicago, Ill.

CHUCKS, DRILL, LATHE AND UNIVERSAL
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Can. Blower & Forge Co., Kitchener, Canada.
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Cushman Chuck Co., Hartford, Conn.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Chicago, Ill.
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Ker & Goodwin, Brantford.
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Thomas Elevator Co., Chicago, Ill.
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Whitney Mfg. Co., Hartford, Conn.
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Victor Tool Co., Waynesboro, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

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Richmond Mfg. Co., Toronto, Ont.

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CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, SPLIT
Rivett Lathe & Grinder Co., Brighton, Mass.

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New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto, Ont.
Warner & Swasey Co., Cleveland, O.

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Hardinge Bros., Inc., Chicago, Ill.

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Johnson Machine Co., Carlyle, Manchester, Conn.
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Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Limited, Galt, Ont.
Stoutenant Co., F. F., Galt, Ont.

COLLETS
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Bannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Inc., Chicago, Ill.
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Whiting Foundry Equipment Co., Harvey, Ill.

CORING MACHINES
Can. Blower & Forge Co., Kitchener, Ont.
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

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Aikenhead Hardware Co., Toronto, Ont.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

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Baird Machine Co., Bridgeport, Conn.
Foster Machine Co., Elkhart, Ind.
Stow Mfg. Co., Binghampton, N.Y.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.

COUPLINGS, PLAIN AND FLEXIBLE
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Gardner, Robt., & Son, Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.

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Northern Crane Works, Walkerville.

CRANES, GANTRY
Northern Crane Works, Walkerville.
Smart Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES, GOLIATH AND PNEUMATIC
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

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Curtis Pneumatic Machy. Co., St. Louis, Mo.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.

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Cleveland Twist Drill Co., Cleveland.
Foss & Hill Machinery Co., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
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Racine Tool & Machine Co., Racine, Wis.
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Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
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Pratt & Whitney Co., Dundas, Ont.
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National-Acme Co., Cleveland, Ohio.
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Wells Brothers Co. of Canada, Galt, Ont.

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A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Ford-Smith Mach. Co., Hamilton, Ont.

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Can. Blower & Forge Co., Kitchener, Ont.
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Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Standard Machy. & Supplies, Ltd., Montreal.
Stow Mfg. Co., Binghampton, N.Y.
United States Mach. Tool Co., Cincinnati, O.
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Bilton Mach. Tool Co., Bridgeport, Conn.
Martin Machine Co., Greenfield, Mass.

DRILLING MACHINES, GANG
Barnes, W. F. & John Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn.
Canada Machinery Corp., Galt, Ont.
Silver Mfg. Co., Salem, Ohio.

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John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
A. B. Jardine & Co., Hespeler, Ont.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Rockford Drilling Mach. Co., Rockford, Ill.

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Hill, Clarke & Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

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Aikenhead Hardware Co., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
De Mooy Machine Co., Cleveland, Ohio.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
D. McKenzie Machinery Co., Guelph, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghampton, N.Y.
United States Mach. Tool Co., Cincinnati, Ohio.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Rockford Drilling Mach. Co., Rockford, Ill.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto, Ont.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Millers Falls Co., Millers Falls, Mass.
H. W. Petrie, Ltd., Montreal.
Pratt & Whitney Co., Dundas, Ont.
R. E. T. Pringle, Ltd., Toronto, Ont.
United States Electrical Tool Co., Cincinnati.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cleveland Twist Drill Co., Cleveland.
Foss & Hill Machy. Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford.

DRILLS, ELECTRIC AND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machinery Co., Toronto.

DRILLS, HIGH SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Can. B. K. Morton, Toronto, Montreal.
H. A. Drury Co., Montreal.
Eagle & Globe Steel Co., Montreal, Que.
Foss & Hill Machy. Co., Montreal.
Marshall & Co., Geo. A., Toronto, Ont.
McKenna Brothers, Pittsburgh, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
W. F. & John Barnes Co., Rockford, Ill.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

DRILLS, MULTIPLE SPINDLE
Henry & Wright Mfg. Co., Hartford, Conn.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Ltd., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRILLS, OIL TUBE
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

DRILLS, PNEUMATIC
Can. Ingersoll Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Niles-Bement-Pond Co., New York
R. E. T. Pringle, Ltd., Toronto, Ont.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Millers Falls Co., Millers Falls, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Dominion Wheel & Foundries, Toronto.
Foss & Hill Machy. Co., Montreal.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
A. R. Williams Machy. Co., Toronto.

DRILLS, TRACK
Cleveland Twist Drill Co., Cleveland.
Clark Equipment Co., Buchanan, Mich.
Foss & Hill Machy. Co., Montreal.
Morse Twist Drill & Mach. Co., New Bedford.

DRILLS, TWIST
Atkins & Co., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Armstrong, Whitworth of Canada, Ltd., Montreal.
Canadian Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

DRINKING FOUNTAINS
Puro Sanitary Dk'g. Fountain Co., Haydenville, Mass.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sheldons, Ltd., Galt, Ont.
R. E. T. Pringle, Ltd., Toronto, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes & Co., Sherbrooke, Que.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

DUST ARRESTERS (FOR TUMBLING MILLS)
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
A. R. Williams Machy. Co., Toronto.

ELEVATOR ENCLOSURES
Canada Wire & Iron Goods Co., Hamilton, Ont.

ELEVATORS AND BUCKETS
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY
Can. Matthews Gravity Carrier Co., Toronto, Ont.

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Stow Mfg. Co., Binghamton, N.Y.

EMERY AND EMERY WHEELS
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Ford-Smith Mach. Co., Hamilton, Ont.
Francis & Co., Hartford, Conn.
Norton Co., Worcester, Mass.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

ENGINES, BALANCED VALVE
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Plessisville Foundry Co., Plessisville, Que.

ENGINES, STEAM, GAS, GASOLINE
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.

ENGINES, HORIZONTAL AND VERTICAL
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Sheldons, Ltd., Galt, Ont.
A. R. Williams Machy. Co., Toronto.

ENGRAVERS
Pritchard-Andrews Co., Ottawa.

ESCUTCHEON PINS
Parmenter & Bulloch Co., Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
H. W. Petrie, Toronto.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
R. E. T. Pringle, Toronto, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

FAUCETS
Puro Sanitary Dk'g. Fountain Co., Haydenville, Mass.

FENCE, IRON AND FACTORY
Canada Wire & Iron Goods Co., Hamilton, Ont.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Can. B. K. Morton Co., Toronto, Ont.
Delta File Works, Philadelphia, Pa.
Marshall & Co., Geo. A., Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Port Hope File Mfg. Co., Port Hope, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

FILING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Conn.

FILTERS, OIL
Bowser & Co., Inc., S. F., Toronto, Ont.

FILTERS, WATER
W. B. Scaife & Sons, Pittsburgh, Pa.

... you, tear it out now and place with ... letters to be answered.

FIRE ESCAPES
Canada Wire & Iron Goods Co., Hamilton, Ont.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FISH PLATES
Can. Steel Foundries, Ltd., Montreal, Que.

FIXTURES
Illinois Tool Works, Chicago, Ill.
Monarch Brass Mfg. Co., Toronto, Ont.

FLEXIBLE SHAFT COILING MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

FLINT SHOT
U.S. Silica Co., Chicago, Ill.

FORGES, HAND, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Canada.
Sheldons, Ltd., Galt, Ont.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE
Can. Billings & Spencer, Ltd., Welland, Ont.
Cumming & Son, J. W., New Glasgow, Canada.
Dom. Forge & Stpg. Co., Walkerville, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont
J. H. Williams & Co., Brooklyn, N.Y.

FORGING HAMMERS, BELT-DRIVEN
Bliss, E. W., Co., Brooklyn, N.Y.
J. H. Williams & Co., Brooklyn, N.Y.

FORGING HAMMERS, STEAM OR AIR
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Erie Foundry Co., Erie, Pa.
Garlock-Walker Machinery Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.

FUEL OIL SYSTEMS
Gilbert & Barker Mfg. Co. Springfield, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FURNACES, ANNEALING, ETC.
Bellevue Industrial Furnace Co., Detroit, Mich.
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Mechanical Engineering Co., Montreal.
Rockwell Co., W. S., New York, N.Y.
Tate-Jones & Co., Leetsdale, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES, BLAST
Toronto Iron Works, Ltd., Toronto.

FURNACES, BRASS, MALLEABLE
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES, HEAT TREATING HARDENING AND TEMPERING
Bellevue Industrial Furnace Co., Detroit, Mich.
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Tate-Jones & Co., Leetsdale, Pa.

FURNACES, FORGING
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.

FURNACES FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Can. Hoskins, Ltd., Walkerville, Ont.
Oven Equipment Mfg. Co., New Haven, Conn.

FUSE BOXES, STEEL
Dom. Forge & Stpg. Co., Walkerville, Ont.

FUSE CAP MACHINERY
Noble & Westbrook Mfg. Co., Hartford, Conn.
R. E. T. Pringle, Ltd., Toronto.

GALVANIZING MACHINERY
Erie Foundry Co., Erie, Pa.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GAS BLOWERS AND EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Limited, Galt, Ont.

GAUGES, MERCURY COLUMN, DRAFT
Chades F. Elmes Eng. Works, Chicago.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l., Montreal, Que.
Pratt & Whitney Co., Hartford, Conn.
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Worth Engineering Co., Toronto, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal, Que.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Dominion Machinery Co., Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Machine Co., Hamilton
D. E. Whitton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.

GEAR HOBBING MACHINES
Himoff Mach. Co., Inc., Astoria, L.I., New York.

GEAR TURNING MACHINES, BEVEL
Bridgeford Mach. Tool Works, Rochester, N.Y.

GEARS, CUT, MORTISE, ANGLE, WORM
Baxter Co., Ltd., J. R., Montreal, Que.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Que.
Illinois Tool Works, Chicago, Ill.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
The Smart-Turner Machine Co., Hamilton.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

GEARS, RAWHIDE
Hamilton Gear & Machine Co., Toronto.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

GENERATORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Toronto.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Sturtevant Co., B. F., Galt, Ont.
A. R. Williams Machy. Co., Toronto.

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland, Ohio.
Willson Co., Inc., T. A., Reading, Pa.

GRAIN FOR POLISHING
Norton Co., Worcester, Mass.

GRAPHITE
Aikenhead Hardware Co., Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

GLOVES, LEATHER AND RUBBER
Hickory Steel-Grip Glove Co., Chicago, Ill.

GLOVES, STEEL GRIP, SAND BLAST
Hickory Steel Grip Glove Co., Chicago, Ill.

GRAVITY CARRIERS
Can. Matthews Gravity Carrier Co., Toronto, Ont.

GREASES (SEE LUBRICANTS)

GRINDER ATTACHMENTS
Rivett Lathe & Grinder Co., Boston, Mass.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, AUTOMATIC KNIFE
W. H. Banfield & Son, Toronto.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Blake & Johnson Co., Waterbury, Conn.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Canada Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Norton Grinding Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, DIE AND CHASER
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
United States Electrical Tool Co., Cincinnati, O.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.
R. E. T. Pringle, Ltd., Toronto, Ont.
Rivett Lathe & Grinder Co., Brighton, Mass.

GRINDERS, NAIL DIE

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago.
Norton Co., Worcester, Mass.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
United States Electrical Tool Co., Cincinnati, O.
A. R. Williams Machy. Co., Toronto.

GRINDERS, RADIAL
Rivett Lathe & Grinder Co., Brighton, Mass.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blake & Johnson Co., Waterbury, Conn.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
National-Acme Co., Cleveland, Ohio.
H. W. Petrie, Ltd., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Wing & Son, J. E., Hamilton, Ont.

GRINDERS, UNIVERSAL, PLAIN
Fitchburg Grinding Machine Co., Fitchburg, Mass.
Modern Tool Co., Erie, Pa.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, VERTICAL SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
H. E. Streeter, 623 New Birks Bldg., Montreal, Que.
Wilmarth & Morman, Grand Rapids, Mich.
Wing & Son, J. E., Hamilton, Ont.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John G., Brantford.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.
Stow Mfg. Co., Binghampton, N.Y.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Carborundum Co., Niagara Falls.
Ford-Smith Mach Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Francis & Co., Hartford, Conn.
Norton Co., Worcester, Mass.
H. W. Petrie, Toronto.

GUARDS, WINDOW AND MACHINE
Canada Wire & Iron Goods Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton Ont.
New Britain Mach. Co., New Britain, Conn.
Stow Mfg. Co., Binghampton, N.Y.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Ford Smith Machine Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Millers Falls Co., Millers Falls, Mass.
Osborn (Canada, Ltd., Sam'l., Montreal, Que.
H. W. Petrie, Ltd., Montreal.
Racine Tool & Machine Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Victor Saw Works, Ltd., Hamilton, Canada.
Zenith Coal & Steel Products, Montreal, Que.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto, Ont.
Garvin Machine Co., New York City.
Millers Falls Co., Millers Falls, Mass.

HAMMERS, AIR
Erie Foundry Co., Erie, Pa.

HAMMERS, DROP AND BELT-DRIVEN
Beaudry & Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canadian Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
High Speed Hammer Co., Rochester, N.Y.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Plessisville Foundry Co., Plessisville, Que.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
West Tire Setter Co., Rochester, N.Y.

HAMMERS, POWER
Beaudry & Co., Boston, Mass.
Erie Foundry Co., Erie, Pa.
United Hammer Co., Boston, Mass.

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
R. E. T. Pringle, Ltd., Toronto, Ont.

HAMMERS, MARKING
Matthews, Jas. H. & Co., Pittsburgh, Pa.

HAMMERS, MOTOR-DRIVEN
Beaudry & Co., Boston, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

HAMMERS, NAIL MACHINE
Tuttel Hammer Co., Boston, Mass.

HAMMERS, STEAM
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.
Hickory Steel-Grip Glove Co., Chicago, Ill

HANGERS, SHAFT
Baird Machine Co., Bridgeport, Conn.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Can. S K F Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal.
Petrie of Montreal, Ltd., H. W., Montreal, Que
H. W. Petrie, Toronto.
Standard Pressed Steel Co., Philadelphia, Pa.

HARDENING AND TEMPERING
Holz, Herman A., 1 Madison Ave., New York.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEATERS
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Sturtevant Co., B. F., Galt, Ont.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Holz, Herman A., 1 Madison Ave., New York.
Shore Instrument & Mfg. Co., New York.

HIGH SPEED TOOL METAL
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E. W. Bliss Co., Brooklyn, N.Y.
Ferracute Machine Co., Bridgeton, N.J.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.
PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.
PRESSES FOR SHELLS
Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Charles F. Elmes Eng. Works, Chicago.
Dominion Machinery Co., Toronto, Ont.
Ferracute Machine Co., Bridgeton, N.J.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Metalwood Mfg. Co., Detroit, Mich.
William R. Perrin, Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
West Tire Setter Co., Rochester, N.Y.
PRESSES, FILTER
William R. Perrin, Ltd., Toronto.
PRESSES, DROP AND FORGING
W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Charles F. Elmes Eng. Works, Chicago.
Can. Fairbanks-Morse Co., Montreal.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Toledo Machine & Tool Co., Toledo.
PRESSES, HYDRAULIC
John Bertram & Sons Co., Dundas.
Charles F. Elmes Eng. Works, Chicago.
Ferracute Machine Co., Bridgeton, N.J.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.
H. W. Petrie, Toronto.
Toledo Machine & Tool Co., Toledo.
West Tire Setter Co., Rochester, N.Y.
A. R. Williams Machy. Co., Toronto.
PRESSES, PNEUMATIC
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.
PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Consolidated Press Co., Hastings, Mich.
Charles F. Elmes Eng. Works, Chicago.
Garlock-Walker Machinery Co., Toronto, Ont.
William R. Perrin, Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
Toledo Machine & Tool Co., Toledo.
A. R. Williams Machy. Co., Toronto.

PRESSES, BALING
William R. Perrin, Ltd., Toronto.
PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Owen, Boggs & Co., Hamilton, Ont.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.
PRESSES, SCREW
Baines, W. F., & John, Co., Rockford, Ill.
Bliss Co., E. W., Brooklyn, N.Y.
Ferracute Mach. Co., Bridgeton, N.J.
William R. Perrin, Ltd., Toronto.
PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Consolidated Press Co., Hastings, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Mach. Co., Bridgeton, N.J.
PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ont.
PULLEYS
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Dominion Machy. Co., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Positive Clutch & Pulley Works, Ltd., Toronto.
Standard Machy. & Supplies, Ltd., Montreal, Que.
The Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
PULLEYS, FRICTION CLUTCH
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Positive Clutch & Pulley Works, Ltd., Toronto.
Bernard Industrial Co., A., Fortierville, Que.
PULLEY MACHINERY
DRILLING AND TAPPING
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Wells Bros. of Canada, Galt, Ont.
PUMPS, AIR
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton.
PUMPS, CENTRIFUGAL
Bowser & Co., Inc., S. F., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.
Smart-Turner Mach. Co., Hamilton.
Sturtevant Co., B. F., Galt, Ont.
PUMPS, FUEL OIL
Bowser & Co., Inc., S. F., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.
PUMPS, HIGH PRESSURE
Blake Pump & Condenser Co., Fitchburg, Mass.
Charles F. Elmes Eng. Works, Chicago.
William R. Perrin, Ltd., Toronto.
Smart-Turner Mach. Co., Hamilton.
PUMPS, ALL KINDS
Blake Pump & Condenser Co., Fitchburg, Mass.
Can. Blower & Forge Co., Kitchener, Ont.
Charles F. Elmes Eng. Works, Chicago.
William R. Perrin, Ltd., Toronto.
H. W. Petrie, Toronto.
Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
PUMPS, HYDRAULIC
Blake Pump & Condenser Co., Fitchburg, Mass.
Charles F. Elmes Eng. Works, Chicago.
Metalwood Mfg. Co., Detroit, Mich.
Smart-Turner Mach. Co., Hamilton.
William R. Perrin, Ltd., Toronto.
PUMPS, LUBRICANT, OIL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bowser & Co., Inc., S. F., Toronto, Ont.
Roper, C. P., Co., Hopedale, Mass.
Trahern Pump Co., Rockford, Ill.
PUMP LEATHERS
Can. B. K. Morton, Toronto, Montreal.
Graton & Knight Mfg. Co., Worcester, Mass.
PUMPS, ROTARY, POWER DRIVEN
Bowser & Co., Inc., S. F., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.
PUNCHES AND DIES
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Blower & Forge Co., Kitchener, Ont.
Ferracute Mach. Co., Bridgeton, N.J.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Mulliner-Enlund Tool Co., Syracuse, N.Y.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Toledo Machine & Tool Co., Toledo, O.
PUNCHES, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Consolidated Press Co., Hastings, Mich.
Ferracute Mach. Co., Bridgeton, N.J.
Niles-Bement-Pond Co., New York.
PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada
Niles-Bement-Pond Co., New York.
W. A. Whitney Mfg. Co., Rockford, Ill.
PURIFYING AND SOFTENING APPARATUS
Seagle & Sons Co., Wm. B., Pittsburgh, Pa.
PYROMETERS
Bellevue Industrial Furnace Co., Detroit, Mich.
Can. Hoskins, Ltd., Walkerville, Ont.
Holz, Herman A., 1 Madison Ave., New York.
Shore Instrument & Mfg. Co., New York City.
H. E. Streeter, New Birks Bldg., Montreal, Que.
Taylor Instrument Co., Rochester, N.Y.
Thwing Instrument Co., Philadelphia, Pa.
QUARTERING MACHINES
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.
RAILING, IRON AND BRASS (SEE GUARDS)
RAIL BENDERS
Niles-Bement-Pond Co., New York.
RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Cumming & Son, J. W., New Glasgow, Canada.
Niles-Bement-Pond Co., New York.
RAILS, STEEL
Cumming & Son, J. W., New Glasgow, Canada.
RATCHETS
Keystone Mfg. Co., Buffalo, N.Y.
RAW HIDE PINIONS (SEE GEARS)
REAMER FLUTING MACHINES
Garvin Machine Co., New York.
REAMERS, ADJUUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
H. E. Streeter, New Birks Bldg., Montreal, Que.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McKenna Brothers, Pittsburgh, Pa.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
R. E. T. Pringle, Ltd., Toronto, Ont.
REAMERS, PIPE, CYLINDER AND LOCOMOTIVE
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
RECORDING INSTRUMENTS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.
REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.
RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland, Ohio.
RIVET MACHINES
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Grant Mfg. & Machine Co., Bridgeport, Conn.
National Machinery Co., Tiffin, O.
H. W. Petrie, Ltd., Montreal.
RIVETS, TUBULAR, BIFURCATED
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.
RIVETS, IRON, COPPER AND BRASS
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ot.
RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
RIVETING MACHINES, ELASTIC ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport, Conn.
High-Speed Hammer Co., Rochester, N.Y.
F. B. Shuster Co., New Haven, Conn.
ROLLS, BENDING AND STRAIGHTENING
John Bertram & Sons Co., Dundas
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo, O.
ROLLS, CRUSHING
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
RUBBER MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland
RULES
Brown & Sharpe Mfg. Co., Providence
James Chesterman & Co., Ltd., Sheffield, Eng.
L. S. Starrett Co., Athol, Mass.
SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland, Ohio.
SAFETY APPLIANCE GOGGLES
T. A. Wilson, Reading, Pa.
SAND BLASTS
Curtis Pneumatic Machinery Co., St. Louis, Mo.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
SANDING MACHINES
Canada Machinery Corp., Galt, Ont.
SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Dominion Machy. Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal
Curtis Pneumatic Machy. Co., St. Louis, Mo.
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto.
A. R. Williams Machy. Co., Toronto
SAWS, CIRCULAR METAL
Hunter Saw & Machine Co., Pittsburg, Pa.
Napier Saw Works, Springfield, Mass.
Tabor Mfg. Co., Philadelphia, Pa.
SAWS, HACK (SEE HACK SAWS)
SAWS, INSERTED TOOTH
Hunter Saw & Mach. Co., Pittsburgh, Pa.
Napier Saw Works, Springfield, Mass.
Tabor Mfg. Co., Philadelphia, Pa.
SAWS, BAND AND COPING
Napier Saw Works, Springfield, Mass.
SCLEROSCOPES
Shore Instrument & Mfg. Co., New York City
H. E. Streeter, New Birks Bldg., Montreal, Que.
SCREW MACHINE PARTS
Johnson Mach. Co., Carlyle, Manchester, Conn.
SCREW MACHINE PRODUCTS
Galt Machine Screw Co., Galt, Ont.
Eastern Mach. Screw Corp., New Haven, Conn.
SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Garvin Machine Co., New York
Himoff Mach. Co., Inc., Astoria, L.I., New York.
A. B. Jardine & Co., Hespeler
New Britain Machine Co., New Britain, Conn.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rivett Lathe & Grinder Co., Brighton, Mass.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto
SCREW MACHINES, AUTOMATIC, MULTIPLE SPINDLE
New Britain Machine Co., New Britain, Conn.
Riverside Machinery Depot, Detroit, Mich.
SCREWS
Can. B. K. Morton, Toronto, Montreal
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio
Steel Co. of Canada, Ltd., Hamilton, Ont.
SCREW PLATES
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wells Bros. Co. of Canada, Galt, Ont.
SCREW SLOTTERS
Garvin Machine Co., New York
Pratt & Whitney Co., Dundas, Ont.
SECOND-HAND MACHINERY
Davis Machine Tool Co., W. F., New York
Dominion Machinery Co., Toronto
Foss & Hill Machy. Co., Montreal
Hill, Clarke & Co., Chicago, Ill.
McCabe, J. J., New York, N.Y.
New York Machinery Exchange, New York
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
Strelinger Co., Chas. A., Detroit, Mich.
Stocker-Rumely-Wachs, Chicago, Ill.
SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto, Ont.
Allen Mfg. Co., Hartford, Conn.
SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.
SHAPERS
John Bertram & Sons Co., Dundas
Can. Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal
Gardner, Robt., & Son, Montreal
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton, Ohio
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto
Rhodes Mfg. Co., Hartford, Conn.
Steptoe Co., John, Cincinnati, Ohio
SHAFTING
Can. Bond Hanger & Coup. Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Niles-Bement-Pond Co., New York
H. W. Petrie, Toronto
Pratt & Whitney Co., Dundas, Ont.
Strelinger Co., Chas. A., Detroit, Mich.
A. R. Williams Machy. Co., Toronto
SHAFTS, FLEXIBLE
Stow Mfg. Co., Binghampton, N.Y.
SHARPENING STONES
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
SHAVINGS, SEPARATOR
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas

... you, tear it out now and place with letters to be answered.

Bertrams, Ltd., Edinburgh, Scotland
Canada Machinery Corp., Galt, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Montgomery, Smith & Co., Keynsham, Somerset, Eng.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo

SHEARS, POWER
John Bertram & Sons Co., Dundas
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Ferrachute Machine Co., Bridgeton, N.J.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
Toledo Machine & Tool Co., Toledo

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Canada

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Peck, Stow & Wilcox, Cleveland, O.
Steel Bending Brake Works, Ltd., Chatham, Ont.

SHEET METAL STAMPINGS
Dominion Forge & Stpg. Co., Walkerville, Ont.

SHELL BANDING MACHINES, HYDRAULIC
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., Wm. R., Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.

SHELL PAINTING MACHINES
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

SHELL RIVETERS
Grant Mfg. & Machine Co., Bridgeport, Conn.
High Speed Hammer Co., Rochester, N.Y.

SHRAPNEL SHELL MARKER
Brown, Boggs & Co., Hamilton, Canada
Noble & Westbrook Mfg. Co., Hartford, Conn.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. B. K. Morton, Toronto, Montreal.

SIGNS, ENAMEL
Strong, Kennard & Nutt Co., Cleveland, Ohio.

SILVER SOLDER
Geo. H. Lees & Co., Hamilton, Ont.

SKATE SHARPENERS
Can. Bond Hanger & Cplg. Co., Alexandria, Ont

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

SLOTTERS
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York
Rhodes Mfg. Co., Hartford, Conn.

SMOKESTACKS
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke, Que.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
J. H. Williams & Co., Brooklyn, N.Y.

SOCKET HEAD CAP SCREWS
Allen Mfg. Co., Hartford, Conn.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Canada

SOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Banfield, W. H., & Sons, Toronto.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Can. Fairbanks-Morse Co., Montreal.
Charles F. Elmes Eng. Works, Chicago.
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Courtland, N.Y.
Grant Mfg. & Machy. Co., Bridgeport, Conn.
John H. Hall & Sons, Brantford.
Himoff Machine Co., Inc., Astoria, L.I., New York.
Hyde Engineering Works, Montreal, Que.
Illinois Tool Works, Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
McClean & Son, F. W., Niagara Falls, Ont.
National-Acme Co., Cleveland, Ohio.
D. McKenzie Machinery Co., Guelph, Ont.
Mulliner & Edlund Tool Co., Syracuse, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rhodes Mfg. Co., Hartford, Conn.
Riverside Machinery Depot, Detroit, Mich.
Sleeper & Hartley, Inc., Worcester, Mass.
Smart-Turner Machine Co., Hamilton, Ont.
T. C. M. Mfg. Co., Harrison, N.J.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal, Que.
Cleveland Wire Spring Co., Cleveland.
Jas. Steele, Ltd., Guelph, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.
Sleeper & Hartley, Inc., Worcester, Mass.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

SPIRAL CONVEYORS
Can. Matthews Gravity Carrier Co., Toronto, Ont.

SPROCKETS, CHAIN
Grant Gear Works, Boston, Mass.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.

SOLDER
Jobborn, Geo. A., Hamilton, Ont.

SPROCKET WHEELS, CAST
Perrin, Wm. R., Toronto.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS
Dillon Mfg. Co., Oshawa, Ont.
Dom. Forge & Stamping Co., Walkerville, Ont.
Hodge & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Canada Machinery Corp., Galt, Ont.
Ferracute Mach. Co., Bridgton, N.J.
Noble & Westbrook Mfg. Co., Hartford, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Matthews, Jas. H. & Co., Hartford, Conn.
Noble & Westbrook Mfg. Co., Hartford, Conn.
Pritchard-Andrews Co., Ottawa, Can.

STAPLE MACHINES
Sleeper & Hartley, Inc., Worcester, Mass.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.
Can. Morehead Mfg. Co., Woodstock, Ont.
H. W. Petrie, Toronto
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Sturtevant Co., B. F., Galt, Ont.

STEEL ALLOY (SEE ALLOY STEEL)

STEEL BENDING BRAKES
Steel Bending Brake Works, Ltd., Chatham, Ont.

STEEL FOR AXES, PLOWS, SAWS, DRILLS, ETC.
Colonial Steel Co., Pittsburgh, Pa.

STEEL, CARBON, FERRO-TUNGSTEN
Can. B. K. Morton, Toronto, Montreal.
Colonial Steel Co., Pittsburgh, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.
Zenith Coal & Steel Products, Montreal, Que.

STEEL, COLD ROLLED
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

STEEL DRUMS
Smart-Turner Machine Co., Hamilton, Ont.

STEEL PRESSURE BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

STEEL, HIGH SPEED
Armstrong Whitworth of Canada, Ltd., Montreal
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Century Steel Co. of America, New York
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Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall & Co., Geo. A., Toronto, Ont.
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H. W. Petrie, Toronto
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Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.; represented in Canada by Norton, Callard & Co., Montreal, Que.
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[illegible]
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